DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-2094

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TRANSMISSION MEASURING SET TS-559A/FT

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

OCTOBER 1951

TRANSMISSION MEASURING SET TS-559A/FT

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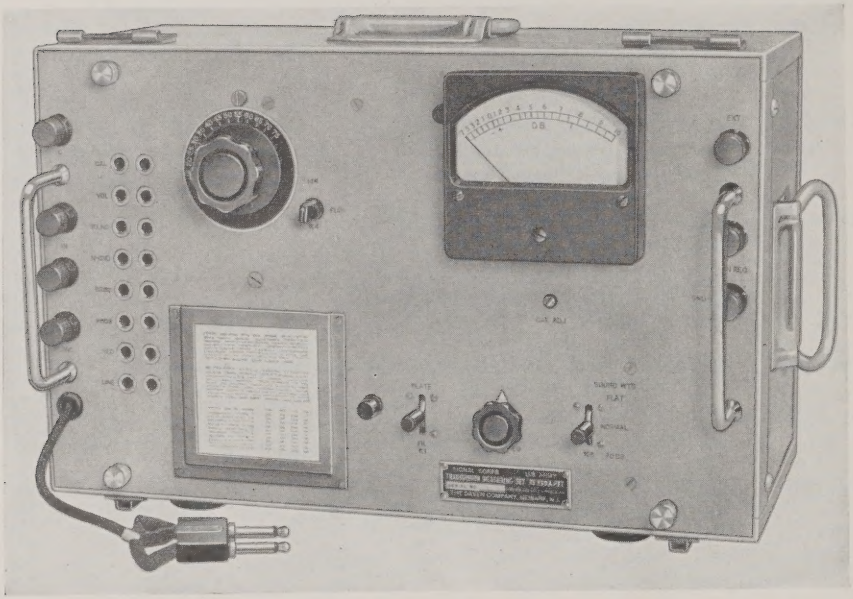


Figure 1. Transmission Measuring Set TS–559A/FT.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual is published for the information and guidance of the personnel to whom this equipment is issued. It contains a physical description of the equipment, operating instructions, field maintenance information, the theory of operation, repair of the equipment, instructions for removing the equipment from service and repacking for shipment or limited storage, and instructions for demolishing the equipment to prevent enemy use. These instructions apply only to Transmission Measuring Set TS–559A/FT.

b. This manual contains five chapters and two appendixes. Appendix I contains a list of references; appendix II contains an identification table of parts.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army equipment and in performing preventive maintenance:

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army), NAV DEPT SERIAL 85P00 (Navy), and AFR 71–4 (Air Force).

b. DA AGO Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer, as prescribed in SR 700–45–5.

c. AF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Matériel Command Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700–45–5 and AFR 65–26.

d. DA AGO Form 419, Preventive Maintenance Checklist for Signal Corps Equipment, will be prepared in accordance with instructions on the back of the form.

e. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. General

a. Transmission Measuring Set TS–559A/FT (fig. 1) is a portable, battery-operated test set, designed to measure noise on telephone circuits. It is used also for transmission measurements, as a flat amplifier, and as an oscillator. The range of measurable noise magnitudes is 10 to 85 db (decibels) below reference level. The measuring set is made up of an amplifier, an attenuator, a db-dial, a db-meter, and an equalizer network. Binding posts, jacks, and switches are arranged on the front panel to facilitate calibration of the set and measuring procedures.

b. The monitoring receiver (monitor-receiver) is an essential component of the measuring set. The high impedance (10,000 ohms) of this telephone receiver provides a sensitive listening set for use by the tester while engaged in making noise measurements.

c. Transmission Measuring Set TS–559A/FT also is used in conjunction with Transmission Measuring Set TS–568/FT (TM 11–2095). This combination provides a visual indicating arrangement for measurements of telephone-circuit harmonic components.

4. Physical Description

a. Transmission Measuring Set TS–559A/FT (fig. 1) is contained in a metal case equipped with three casket type handles. Four metal feet on the bottom and four on the front of the case offer protection when the equipment is used in either the

horizontal or vertical position. The case has a hinged, detachable cover held in place by two latches. On the inside of the case cover (fig. 3) is a rack for the four dummy plugs, a compartment to hold the monitoring receiver when it is not in use, a circuit label, and a battery connection diagram. The dimensions of the case are 18 inches long by 10 inches high by 11½ inches deep overall. The total weight of the unit, including batteries, is approximately 56 pounds; the volume is approximately 1.2 cubic feet.

b. The set requires two 1.5-volt batteries (BA-23) to supply filament voltage and six 22.5-volt batteries (BA-2) to supply plate voltage. A battery compartment (fig. 3), supplied with permanent leads, is located in the bottom of the case. Two wooden retaining strips hold the batteries firmly in place. A padded block on the inside of the cover depresses the filament switch (key) K2, when the cover is closed. This cuts off the battery supply and prevents unnecessary use of the batteries.

c. All controls, and the meter, jacks, switches (keys), and binding posts are mounted on the control panel of the set (fig. 1). The panel is held in the case by means of four thumbscrews, secured to floating anchor nuts located in the four corners of the case. Two handles on the panel permit easy removal from the case, and provide supports to protect the meter and controls when the panel is turned over for maintenance purposes. An instruction card (fig. 13), mounted on the panel, gives brief operating instructions and the calibration constants associated with the various input circuits and frequency weightings.

5. Technical Characteristics

Noise on a telephone circuit is measured in terms of interference with audible reception. The influencing factors which, in general, determine the magnitude of noise interference are frequency composition, relative extent and spacing of the various frequencies, duration of the noise, type of circuit, type of telephone set, and sensitivity of the listener's hearing. Circuits between the noise input jacks and the meter simulate a person's hearing. A weighting network is used for noise measurements; the network attenuates the frequencies in inverse ratio to the interfering effects. Thus, for a given application, two noises measured with a given frequency weighting are approximately equal in interfering effect. Noise measurements of a telephone circuit usually require a separate test of the receiver because telephone sets equipped with No. 144 receivers have different weighting characteristics than do handsets equipped with F1A transmitters and HA1 receivers (par. 17). The instruction card (fig. 13) on the panel gives the proper input jacks and switch positions for the various measurements. Table I, tabulated data, gives technical and performance characteristics for each combination of input circuit and frequency weighting normally used.

Note.—No. 144 receiver (Signal Corps stock No. 4B3144) is a hand type receiver used with various types of telephone equipment. Telephone Sets TP–6 and TP–6–A, for example, are cradle desk sets with handsets containing F1A transmitter elements and HA1 receiver elements.

6. Packaging Data

a. When packing for export shipment, place Transmission Measuring Set TS–559A/FT in a moisture-vaporproof container and pack in a wooden crate. A cutaway view of a typical set, packed for export, is shown in figure 2. The size, weight, and volume of the packed equipment are 14 inches high by 23 inches wide by 15½ inches deep; the weight is 58 pounds; the volume is 2⁹⁄₁₀ cubic feet.

b. Package the transmission measuring set in accordance with the following procedures:

(1) Cushion the set on all surfaces with cells and/or pads of corrugated fiberboard. Place the cushioned set, together with technical manuals and desiccant, within a close-fitting corrugated box.

(2) Place the boxed set within a moisture-vaporproof barrier and heat-seal the closure.

(3) Place the moisture-vaporproof set within a second corrugated fiberboard box with the entire inclosure sealed with water-resistant tape or adhesive.

(4) Place the box within a nailed wooden shipping container which is lined with a sealed, waterproof bag. If it is to be shipped overseas, bind the box with two metal straps.

Table I.—Tabulated Data

Input jacks	Nominal input impedance	Input connected to [a]	Weighting		Dummy plugs	Switch K3	Switch K4	Calibration constant	Range of measurable inputs [b]	1,000-cycle voltage for 0-db readings [c]
			Kind	Fig.						
LINE	Balanced, 600 ohms.	600-ohm line.	144 line	6	None	NORMAL	144	None	10 to 85 dba	24.5 mv.
			F1A line	6	None	NORMAL	F1A–HA1	+7 db	17 to 92 dba	43.5 mv.
			Flat	7	SOUND	FLAT	144	−16 db	−6 to 69 db RN	24.5 mv.
REC	Balanced, 2,000 ohms.	144 rec	144 rec	6	None	NORMAL	144	None	10 to 85 dba	19.5 mv.
		557 rec	144 rec	6	None	NORMAL	144	+5 db	15 to 90 dba	10.1 mv.
		HA1 rec	HA1 rec	6	None	NORMAL	F1A–HA1	+7 db	17 to 92 dba	24.6 mv.
PROG	Balanced, 600 ohms.	600-ohm line.	Program	7	None	NORMAL	144	None	10 to 85 dbRN	24.5 mv.
BRDG	Balanced, 6,000 ohms.	600-ohm line.	144 line	6	None	NORMAL	144	+11 db	21 to 96 dba	24.5 mv.
			F1A line	6	None	NORMAL	F1A–HA1	+18 db	28 to 103 dba	43.5 mv.
			Program	7	PROG	NORMAL	144	+11 db	21 to 96 dbRN	24.5 mv.
			Flat	7	SOUND	FLAT	144	−5 db	5 to 80 dbRN	24.5 mv.
N–GND	100,000 ohms [d]	Line and ground.	144 line	6	None	NORMAL	144	None	10 to 85 dba	4.1 mv to gnd.
			F1A line	6	None	NORMAL	F1A–HA1	+7db	17 to 92 dba	7.2 mv to gnd.
			Program	7	PROG	NORMAL	144	None	10 to 85 db RN	4.1 mv to gnd.
			Flat	7	SOUND	FLAT	144	−16 db	−6 to 69 db RN	4.1 mv to gnd.
SOUND	Unbalanced, 600 ohms.	Auxiliary equipment.	40-db sound	7	None	NORMAL	144	−17 db	−7 to 68 db RN	24.5 mv.
			70-db sound	7	None	70 db	144	−17 db	−7 to 68 db RN	24.5 mv.
			Flat	7	None	FLAT	144	−17 db	−7 to 68 db RN	24.5 mv.
VOL	500,000 ohms.	600-ohm line.	Flat	7	None	FLAT	144	−43 db	−23 to 37 vu [e]	.775 v.

[a] With the LINE or PROG input, the noise meter is used to terminate the line or circuit being tested. With the REC, BRDG, or VOL input, the noise meter is bridged across the circuit being tested. Lines with impedance other than 600 ohms can be tested if suitable impedance corrections are used.

[b] The highest readable value, for all inputs except VOL, may be increased by 30 db by inserting dummy plugs in the VOL jacks.

[c] 1,000-cycle input voltage which will give a corrected 0-db reading (decibel dial plus meter plus calibration constant).

[d] 80,000 ohms between input wires; 100,000 ohms between ground and input terminals connected together.

[e] This assumes a reading of +5 db on indicating meter.

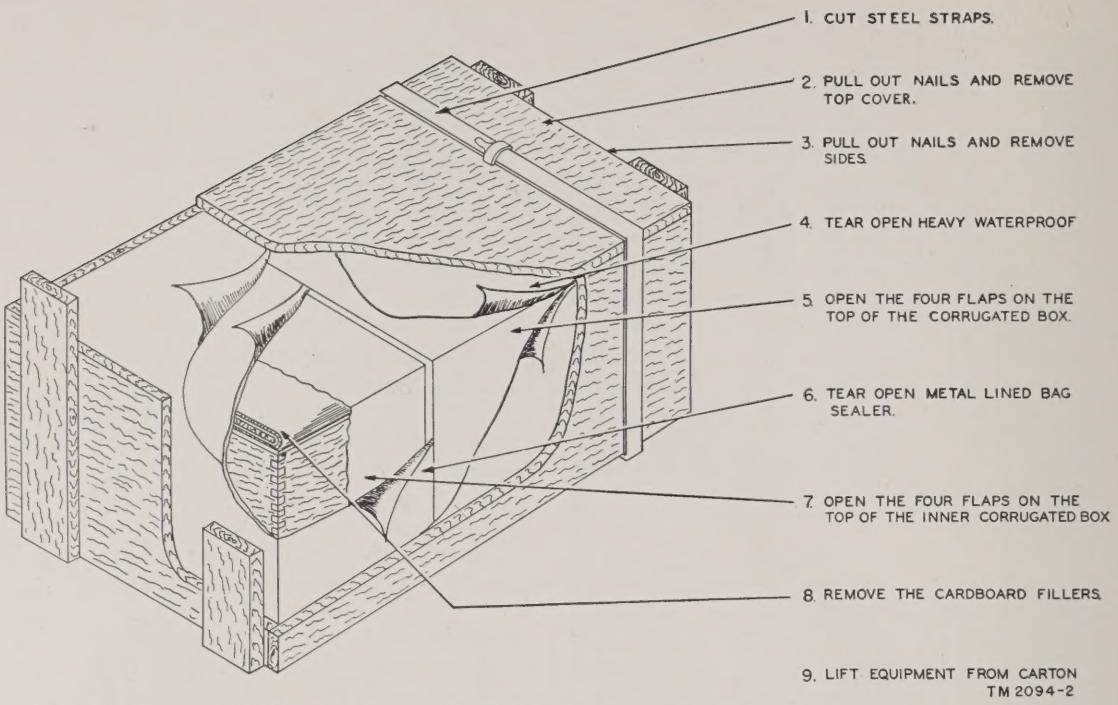

1. CUT STEEL STRAPS.
2. PULL OUT NAILS AND REMOVE TOP COVER.
3. PULL OUT NAILS AND REMOVE SIDES.
4. TEAR OPEN HEAVY WATERPROOF
5. OPEN THE FOUR FLAPS ON THE TOP OF THE CORRUGATED BOX.
6. TEAR OPEN METAL LINED BAG SEALER.
7. OPEN THE FOUR FLAPS ON THE TOP OF THE INNER CORRUGATED BOX
8. REMOVE THE CARDBOARD FILLERS.
9. LIFT EQUIPMENT FROM CARTON
TM 2094-2

Figure 2. Transmission Measuring Set TS–559A/FT, unpacking.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

7. Service Upon Receipt of New Equipment

a. Uncrating, Unpacking, and Checking. Equipment may be shipped in oversea packing cases or in domestic packing cases, and sometimes in its own carrying case. When new equipment is received, select a location where the equipment may be unpacked without exposure to the elements. When uncrating and unpacking Transmission Measuring Set TS–559A/FT, be careful not to damage the equipment by thrusting tools into the interior of the container. Do not damage the packaging material more than necessary. After the measuring set has been unpacked, store the inside packaging material in the shipping container for future use. Equipment shipped in its own case requires no special unpacking instructions aside from checking to determine that the equipment is not damaged.

b. Step-by-Step Instructions for Uncrating and Unpacking Export Shipments (fig. 2).

(1) Cut and fold back the metal straps.
(2) Remove the nails with a nail puller and lift off the top of the shipping container.
(3) Cut the tape and seals of the case liner, and be careful to avoid damaging the waterproof paper.
(4) Lift out the fiberboard pads which are used for blocking and bracing the equipment.
(5) Lift out the packaged measuring set. Carefully remove the waterproof wrap.
(6) Cut the tape which seals the top flaps of the carton, and be careful to avoid damaging the carton. Open the carton and remove the moisture-vaporproof package.
(7) Cut off the moisture-vaporproof barrier. Remove the inner carton.
(8) Open the inner box and remove the top cushioning cells and/or pads. Remove the desiccant and packaged technical manuals. Lift out the measuring set.
(9) Store the interior packaging material (except the desiccant) in the inner carton for future use.
(10) Thoroughly inspect the equipment for possible damage during shipment.
(11) Check the contents of the packing case against the master packing slip.

c. Unpacking Domestic Packing Cases. The instructions given in *b* above apply to unpacking domestic shipments with the exception of cutting the metal bands. Domestic packing cases are not bound with metal straps.

8. Preparation for Use

a. Remove the cover from the case.

b. Check the control panel for chipped, cracked, or damaged parts.

c. Check the switches and db dial for ease of movement and positive action.

d. Remove accumulations of dust, dirt, and grease by wiping with a clean, dry cloth.

e. Remove the panel from the case by unscrewing the four thumbscrews at the four corners of the panel, and then lift the panel by means of the handles.

f. Remove the wooden retaining strips from the battery compartment (fig. 3) by sliding them against the pressure springs and then lifting them out.

g. Install two 1.5-volt batteries (BA-23) and six 22.5-volt batteries (BA-2) in the battery compartment.

h. Connect battery leads as shown in the battery connections diagram located in the cover of the case (fig. 3).

Caution: Be sure that the polarity of the cells is not reversed.

i. Replace the wooden retaining strips; otherwise the batteries may become loose and damage the equipment.

j. Check the electron tubes and tube shields.

k. Replace the panel.

Note. The above instructions for servicing new equipment are applicable to used or reconditioned equipment.

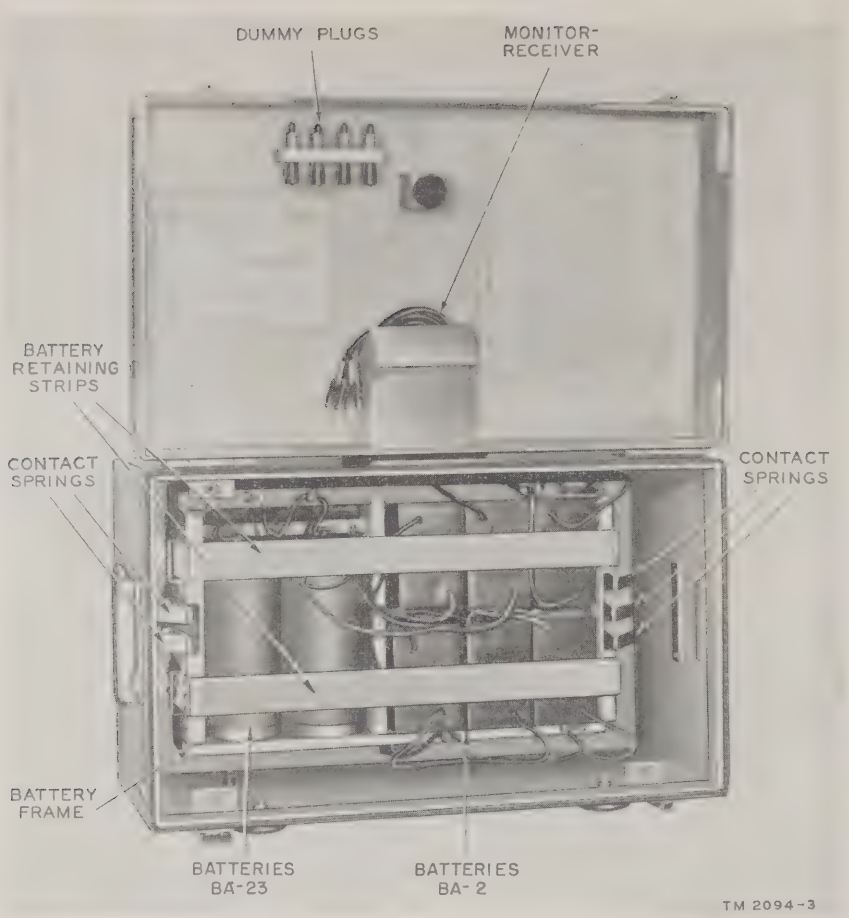


Figure 3. Transmission Measuring Set TS–559A/FT case, panel removed, showing battery compartment.

Section II. CONTROLS AND INSTRUMENTS

9. Controls

Table II lists the controls, their locations on the control panel (fig. 1), and their functions.

10. Panel Connections

a. There are seven binding posts on the control panel (fig. 1), four on the left, and three on the right. Table III gives the designations, locations, and functions of the binding posts.

b. The input circuit jacks, located at the left side of the panel (fig. 1), are used for connecting the circuit under test to the appropriate measuring set test circuit by means of the input plug. The plug cord is internally connected to the IN binding posts. Table IV lists the jacks and their associated test circuits and functions.

11. Instruments

The meter (M1) is the only instrument used in Transmission Measuring Set TS–559A/FT. The meter (fig. 1), is a d-c (direct-current) milliammeter, having a resistance of 2,000 ohms and a full-scale deflection at approximately 300 μa (microamperes) d-c. The meter scale is graduated in db over a range of -7 to $+10$. A red mark on the meter scale (between $+7$ and $+8$) is used in calibration, and in checking the condition of the filament and plate batteries (par. 13). The dynamic characteristics of the meter are such that its response approximates the speed of appreciation of sounds by the human ear.

Table II.—Controls

Control	Location	Function
Decibel dial	Right of CAL jacks	Dial readings are associated with meter readings in computing measurements.
Weighting switch K4	Between decibel dial and meter	Governs selection of either 144 or F1A weighting, in association with appropriate input circuit.
Battery supply switch K2	Between instruction card and switch K1.	Controls the supply of battery to electron tubes.
CAL ADJ (R41)	Directly below the meter case	Meter-needle adjusting screw.
Calibration switch K1	Between switch K2 and FIL RHEO dial.	In PLATE position, it shows the meter-needle setting. In FIL position, in conjunction with FIL RHEO dial, it permits proper setting of meter needle.
FIL RHEO dial (R40)	Between switches K1 and K3	To adjust filament voltage.
SOUND WEIGHTING switch K3.	To the right of FIL RHEO dial	Provides three weighting networks for sound measurements.
Resistor R42	Partially concealed button plug (fig. 1) left of meter case.	Primary calibration adjustment. Operated with screw driver by removing button plug.

Table III.—Binding Posts

Designations*	Location	Function
C (E4)	Left top post	Used only when Transmission Measuring Set TS–568( )/FT, is used in conjunction with Transmission Measuring Set TS–559A/FT.
IN (two: E3, E2)	Left middle posts	For connections to circuit under test.
GND (E1)	Left bottom post	For ground connection.
EXT (E7)	Right top post	Used with MON REC GND post for connecting an external d-c meter or other external apparatus.
MON REC (two: E6, E5; lower marked GND).	Right bottom posts	For connections to the monitor-receiver, used for monitoring.

*Data in parentheses are reference symbols which do not appear on the control panel.

Table IV.—Input Circuit Jacks

Jacks	Input circuit	Function of test circuit
CAL—J15, J16	CAL	Used for calibrating the set. Other jacks must not be in use when calibrating.
VOL—J13, J14	VOL	Used to measure volume on voice or program circuits.
SOUND—J11, J12	SOUND	Used to measure acoustic sound levels. Three weightings are available by means of switch K3. Used with FLAT weighting for measurements of frequency characteristics, transmission levels, and other special measurements.
N–GND—J9, J10	N–GND	Used to measure noise-to-ground on voice or program circuits.
BRDG—J7, J8	BRDG	Used to measure noise and crosstalk on voice or program circuits, without removing them from service. Used only on bandwidth of 5,000 cycles or less.
PROG—J5, J6	PROG	Used to measure noise on program circuits (8,000 cycles or narrower bandwidth).
REC—J3, J4	REC	Used to measure noise in telephone receivers.
LINE—J1, J2	LINE	Used to measure metallic circuit noise at any point on a telephone circuit except the receiver.

12. Equipment Connections

a. Connections. Connect the circuit under test to the IN binding posts (fig. 1) which are connected internally to the 2-conductor cord and input plug. The plug tips complete the cord circuit; the sleeves serve no electrical purpose. Select the appropriate jacks (table IV) for the kind of weighting required (table I). For example, to measure noise in a telephone receiver, insert the input plug in the REC jacks.

b. Grounding. Connect a ground lead to the GND (left bottom) binding post. The sleeves of the input circuit jacks are connected to this GND post and thus are grounded to the measuring set case.

13. Calibration

Calibrate Transmission Measuring Set TS–559A/FT (*a* through *g* below) before making measurements. Check the calibration several times during the first hour the set is used and at frequent intervals during extensive tests. If the set has not been used for several months, calibrate the set as directed in paragraph 54.

a. Turn on the filament supply by pulling out switch K2, and wait a minute for the filaments to heat.

b. Insert the input plug in the CAL jacks.

Caution: All jacks except the CAL jacks should be empty when calibrating the set.

c. Set the db dial on 40 and operate switch K4 to the 144 position.

d. Operate switch K1 to the FIL position and regulate the filament voltage (if necessary) by operating the FIL RHEO dial until the meter needle rests on the red mark. If it rests below the red mark after attempted adjustment, replace Batteries BA-23 (fig. 3).

e. Operate switch K1 to the PLATE position. The meter needle should rest at or beyond the red mark; if it does not, replace Batteries BA-2.

f. Operate switch K1 to the normal position.

g. Adjust (with a screw driver) CAL ADJ resistor R41 (fig. 1) until the meter needle rests on the red mark. The set then is ready for measurements.

14. Calibrations for F1A and HA1 Weightings

When the set is used primarily for measurements on F1A line weighting or HA1 receiver weighting, calibrate the set to read directly in terms of dba (decibel adjusted); no calibration constant is added to the sum of the db meter and db-dial readings. The calibrating procedure given in paragraph 13 is the same for F1A and HA1 weightings, except as follows: Set the db dial on 35 (instead of 40) and operate switch K4 to the F1A position (instead of the 144 position). If it is impossible to adjust the CAL ADJ resistor (par. 13*g*) to obtain a meter reading at the red line, install new batteries, especially the first unit of Battery BA-2.

15. Noise Measurement Terms

The indicating meter and the db dial of the transmission measuring set are calibrated in db. The calibration constants, referred to in the following paragraphs, are in db. For each combination of input circuit and frequency weighting, the reference or zero point of the meter scale is representative of a definite value of power at a calibrating frequency of 1,000 cycles. This reference power corresponding to 0 db on the meter depends on whether the readings are expressed in dbRN (decibel reference noise), dba, or vu (volume unit).

a. Decibel Reference Noise. Electrical circuit noises are referred to a zero or reference power of 1 micromicrowatt (90 db below standard testing power of 1 mw (milliwatt); this is called reference noise (RN)). A greater noise is expressed as dbRN; for example: a meter reading and db-dial setting which total 35 represent 35 dbRN or 55 db below 1 mw. With K4 in the 144 position, the reading will be in dbRN.

b. Decibel Adjusted. In order to obtain equal interfering effects for equal noise meter readings, when different types of receivers are used, it is necessary to establish an adjustment constant. This is done by adjusting the noise meter readings, obtained with F1A line and HA1 receiver weightings, by the amounts determined in comparative listening tests. When this adjustment constant is used, the noise is expressed in dba instead of dbRN. With switch K4 in the F1A position for line weighting, an adjustment of −5 db is included in the calibration constant for the LINE, BRDG, and N-GND input circuits. For HA1 receiver

weighting, and adjustment of −4 db is included in the calibration constant for the REC input circuits.

c. Volume Unit. Vu is used to express rapid fluctuations in power levels. Music or spoken words, for example, produce such fluctuations. Readings are expressed in vu (par. 28) when the VOL input circuit is used with switch K3 in the SOUND WTG FLAT position (fig. 1).

16. General Operating Procedure

Instructions for the general type of measurements are given in paragraphs 17 through 30 and 32. Other uses of the set, such as the one described in paragraph 3*b*, generally require auxiliary equipment and special measuring procedures. Calibration constants for each combination of input circuit and frequency weighting are given in table I and on the panel instruction card. The calibration constant is added to the sum of the db-dial setting and meter reading. The general measuring procedure and the precautions outlined below are applicable to all measurements and will not be repeated for the individual tests.

a. Check the calibration (par. 13).

b. Set the db dial at 75. This dial should be kept at 75, except when calibrating or making measurements, to protect the meter from possible overload.

c. Connect the circuit under test to the IN binding posts. Be careful to protect the input circuit from excessive voltages that may be harmful to the set.

d. Insert the input plug into the proper jacks and operate switches K3 and K4 to the proper positions.

e. Adjust the db dial until a suitable deflection is obtained on the meter.

f. Connect the monitor-receiver to MON REC binding posts. It is advisable to use the monitor-receiver frequently to aid in identifying the type of noise being measured.

g. When the set is not in use, be sure that the filament switch K2 is depressed to prevent needless battery drain.

17. Frequency Weighting

a. Line Weighting. Use line weighting for all measurements of noise on telephone circuits that are used ordinarily for conversations. Since most of the interfering noise (distortion) occurs in the telephone set, a single weighting may be used for measurement at any point in the circuit except the receiver, where receiver weighting (*b* below) must be used. The characteristics of line weighting are shown in figure 6. The dotted curve represents 144 line weighting and takes account of the relative interfering effects of different noise frequencies on a telephone line when a 144 receiver is used. The solid curve represents F1A weighting and takes account of the relative interfering effects of different noise frequencies when an HA1 receiver is used. The operation of switch K4 will govern the selection of 144 line weighting or F1A line weighting (table I). The desired input circuit is obtained by inserting the input plug in LINE, BRDG, or N–GND jacks.

b. Receiver Weighting. To measure receiver noise, bridge the measuring set (which is of relatively high impedance) across the receiver. The weighting is given in terms of relative voltages across the receiver to produce a constant interfering effect. The characteristics of receiver weighting are shown in figure 6. The dotted curve represents receiver weighting for the 144 and the 557 receivers, and the solid curve applies to HA1 receivers. Receiver weighting is obtained by operating switch K4 to the F1A position and by inserting the input plug in the REC jacks.

c. Program Weighting. The bandwidths transmitted by different program circuits are between 3,000 and 8,000 cycles; however, the weighting network used in this set is designed for approximately 8,000 cycles. When this network is used on a circuit of narrower bandwidths, the noise measured will not exceed the noise which would be obtained if a special network were used, because the circuit does not transmit frequencies above its cut-off. Bandwidths above 8,000 cycles cannot be measured satisfactorily on this set. The characteristics of program weighting are shown in figure 7. Program weighting is obtained by inserting the input plug in the PROG jacks, with switch K4 in the 144 position.

d. Sound Weighting. Three weighting networks are available for measurement of acoustic sound levels. All of these weightings are available for sound measurements by inserting the input plug in the SOUND jacks. The characteristics of these weightings are given in figure 7. The calibration constant is given in paragraph 29.

SOUND WTG switch K3 controls the three weightings as described below:

(1) In the NORMAL position, couplings between the amplifier stages provide the frequency characteristics required for measurements of moderate sounds about 40 db above the threshold of hearing.

(2) In the 70 DB position, the weighting coupling between the amplifier stages 1 and 2 is removed; this provides a weighting suitable for fairly loud acoustic sounds.

(3) In the FLAT position, the weightings provided by the coupling between amplifier stages 1 and 2, and 2 and 3, are removed, and the amplifier has a nearly flat frequency-gain characteristic. The flat sound weighting is used also with LINE, BRDG, N-GND, and VOL inputs for other measurements (table I). When flat weighting is used with any of these inputs, the input plug is inserted in the input jacks, dummy plugs are used in the SOUND jacks, and switch K3 is operated to the FLAT position.

18. Audio Circuit Noise With 144 Weighting

For noise measurements using the LINE input circuit with 144 line weighting, refer to table I or the instruction card for proper jacks and switches. Noise measurements will be the sum of the db-dial setting plus the meter reading. With this setting, a 0-db reading corresponds to RN, or its equivalent 0 dba. Since there is no calibration constant, readings are directly in dbRN.

19. Audio Circuit Noise With F1A Weighting

For noise measurements using the LINE input circuit with F1A weighting, refer to table I and the instruction card for the proper jacks and switches. Noise measurements will be the sum of the db-dial setting, the meter reading, and the calibration constant. Readings will be in dba. When

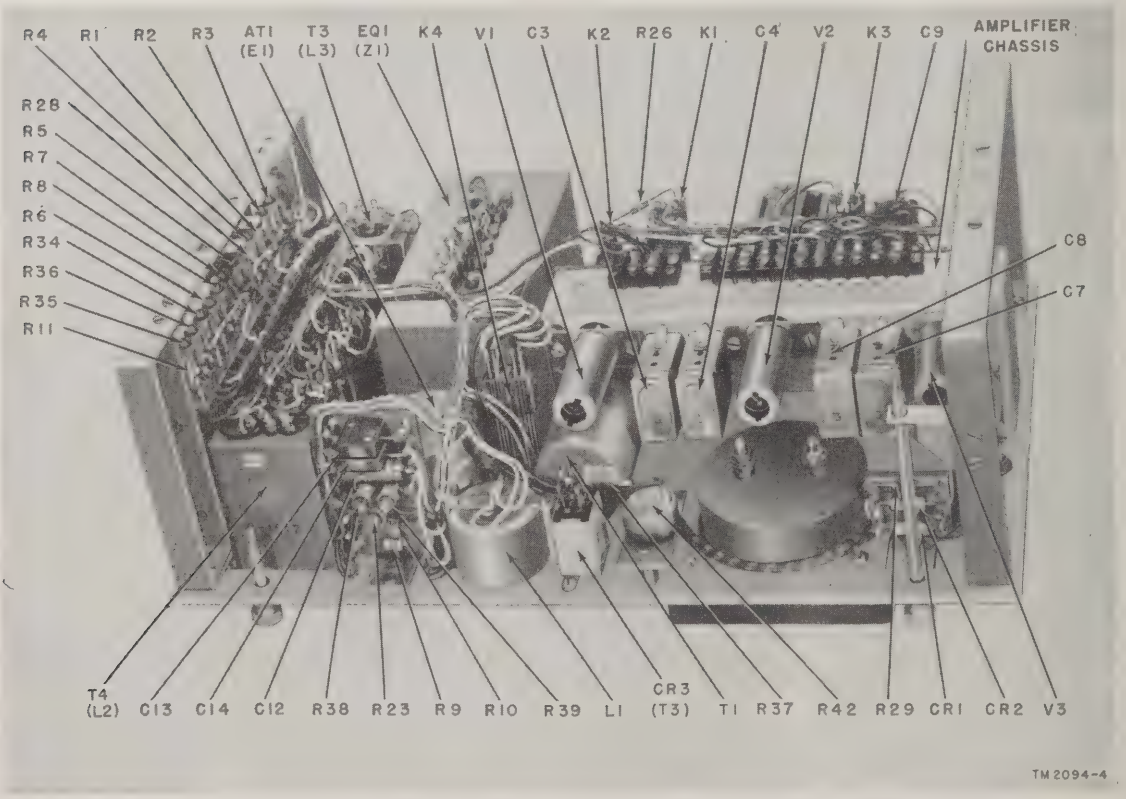


Figure 4. Transmission Measuring Set TS-559A/FT, rear view of panel.

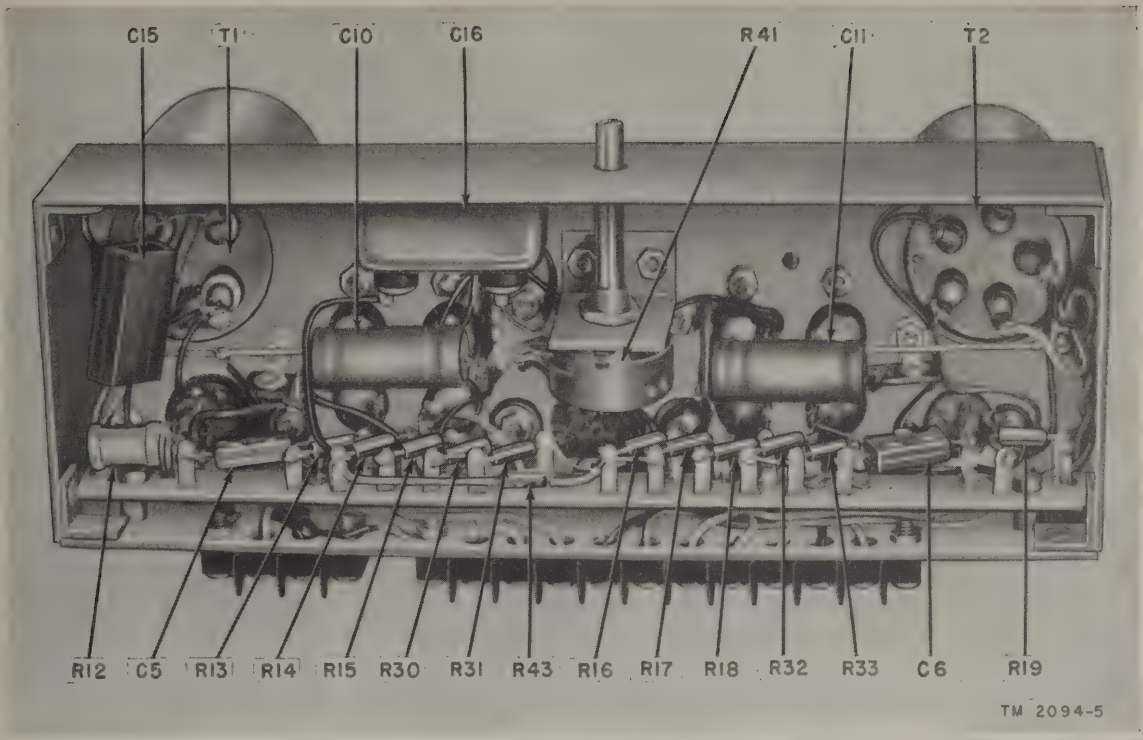


Figure 5. Transmission Measuring Set TS–559A/FT, amplifier chassis removed.

this setting is used, there is a 12-db loss in the set due to the F1A weighting circuit. This necessitates a correction of +12 db. In addition, there is an adjustment constant of −5 db due to the difference in receivers; thus, the net calibration constant is +7 db.

20. LINE Input Circuit With Flat Sound Weighting

For measurements of noise when the LINE input circuit is used with flat sound weighting, refer to table I for the proper jacks, switches, and dummy plugs. The sensitivity of the set is near its peak with this setting and will read 16 db high at RN. Thus, noise measurements will be the sum of the db-dial setting, the meter reading, and a calibration constant of −16 db, expressed in dba.

21. Receiver (144) Noise

Measurements of receiver noise, when the REC input circuit is bridged across a 144 receiver, requires 144 receiver weighting. Refer to table I and the instruction card for the proper jacks and switches. The sensitivity of the set is designed so that a 0-db reading corresponds to RN. Thus, the noise measurement will be the sum of the db-dial setting and the meter reading, expressed either in dbRN or dba.

22. Receiver (557) Noise

For measurements of receiver noise when the REC input circuit is bridged across a 557 receiver with 144 receiver weighting, refer to table I and the instruction card for the proper jacks and switches. Because of the difference in impedance between the 557 and 144 receivers, there is a correction of +1 db in addition to the calibration constant of +4 db for the 557 receiver. Thus, noise measurements will be the sum of the db-dial setting, the meter reading, and the calibration constant of +4 db, expressed in dba.

23. Receiver (HA1) Noise

Measurements of receiver noise when the REC input circuit is bridged across an HA1 receiver require HA1 receiver weighting. Refer to table I

and the instruction card for the proper jacks and switches. There is a loss in the sensitivity of the set of about 11 db at 1,000 cycles, due to the HA1 weighting circuit. Because of the difference in receivers, there is a correction factor of −4 db. Thus, noise measurements will be the sum of the db-dial setting, the meter reading, and the calibration constant of +7 db (11−4), expressed in dba.

Note.—When strictly comparable results are desired in a series of measurements using the REC input, variations due to receiver impedance differences may be avoided by measuring across a particular receiver of a given type. Place the receiver under test on a felt pad to reduce room-noise interference.

24. Program Circuit Noise

For measurements of program circuit noise, refer to table I and the instruction card for the proper jacks and switches. The sensitivity of the set is designed so that a 0-db reading corresponds to the RN; thus, the noise measurements will be the sum of the db-dial setting and the meter reading, expressed in dbRN.

25. Bridging Circuit With 144 Line or Program Weighting

For measurements of noise when the BRDG input circuit is connected across a 600-ohm line, with either line or program weighting, refer to table I for the proper jacks, switches, or dummy plugs. Since the BRDG input circuit has an impedance of about 6,000 ohms, the set will read 11 db too low as compared with the LINE input circuit. Thus, noise measurements will be the sum of the db-dial setting, the meter reading, and a calibration constant of +11 db, expressed in dba.

26. Audio Noise, Bridging Circuit With F1A Weighting

For measurements of noise when the BRDG input circuit is connected across a 600-ohm line with F1A weighting, refer to table I for the proper jacks and switches. The calibration constant due to the BRDG circuit will be +11 db (par. 25), but there is an additional calibration constant due to the F1A weighting (+12 db) and F1A receivers (−5 db); thus, the noise measurement will be the sum of the db-dial setting, the meter reading, and a calibration constant of +18 db (11+12−5), expressed in dba.

27. Noise-to-Ground

For measurements of noise-to-ground using the N–GND input circuit, refer to table I for the proper jacks, switches, and dummy plugs. The calibration constants used for the LINE and PROG input circuits are applicable to the N-GND input circuit. When measuring noise-to-ground on a working circuit, connect the working circuit leads to the IN binding posts and connect the lower left GND binding post to a suitable ground. When measuring noise-to-ground on a single wire, connect the single wire line under test to both IN binding posts and connect the lower left GND binding post to a suitable ground.

28. Volume

For measurements of volume, use the VOL input circuit with flat sound weighting. Refer to table I and the instruction card for the proper jacks and switches. The input impedance is approximately 500,000 ohms; therefore, the set may be considered as a high-impedance voltmeter. With this input bridged across a 600-ohm circuit, the set will read 43 db too high; thus, readings will be the sum of the db-dial setting, the meter reading, and a calibration constant of −43 db, expressed in vu. Blocking capacitors are not provided in this input circuit.

Caution: Do not connect a circuit with d-c potential above 56 volts to the input of the measuring set.

29. Sound Level

When the SOUND input circuit is used with any of its three weightings (40 db, 70 db, or flat), the sensitivity is essentially the same (within ±.5 db). The calibration constant is −17 db, which is 1 db greater than flat weighting on the LINE or N-GND input circuits. This loss is due to the 600-ohm repeating coil in the N-GND input circuit.

30. Transmission Measurements

When Transmission Measuring Set TS–559A/FT is used for loss and gain measurements, proceed as follows:

a. Check the calibration of the set.
b. Set the db dial at 75.
c. Operate switch K3 to the FLAT position.
d. Operate switch K4 to the 144 position.

e. Insert the input plug in the LINE jacks, and dummy plugs in the SOUND jacks.

f. Insert dummy plugs in the VOL jacks to reduce the sensitivity of the set by 30 db.

g. Transmission measurements may be obtained directly in dbm (db referred to 1 mw in 600 ohms) when the calibration constant of −76 db is applied to the sum of the db-dial setting and meter reading. The measuring range is from −66 to +9 dbm.

h. When the 30-db pad is not used, dummy plugs are not inserted in the VOL jacks (*f* above). The calibration constant will be −106 db. The measuring range is from −96 to −21 dbm.

31. Use as Oscillator

Transmission Measuring Set TS–559A/FT may be used as a source of a-c (alternating-current) power, which is provided by the calibrating feedback circuit (par. 45*b*). The procedure for such use follows:

a. Check the calibration of the set.

b. Leave the input plug in the CAL jacks.

c. Operate switch K1 to the FIL position.

d. Connect the apparatus which is to be energized to binding posts EXT and MON REC GND.

e. Check the sending level by using another Transmission Measuring Set TS–559A/FT (par. 30). The output power, across a 600-ohm line, is approximately −5 dbm at 1,000 cycles.

f. The output impedance is about 350 ohms unbalanced to ground. When a balanced circuit is required, connect a 2 to 1 repeating coil between the EXT and GND binding posts and the external circuit.

32. Measurement of Transmission Level

Measurements of transmission level may be made on properly terminated circuits by the following procedure:

a. Check the calibration of the set.

b. Set the db dial at 75.

c. Operate switch K3 to the FLAT position.

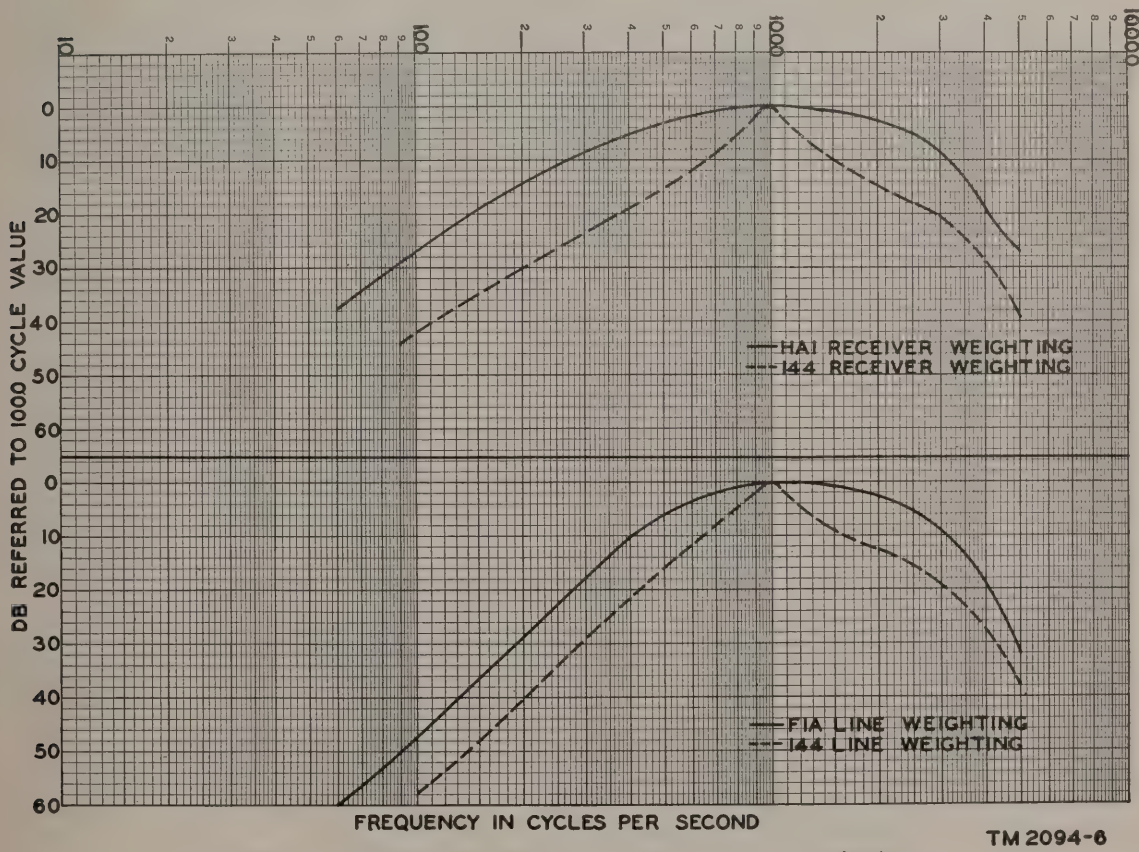


Figure 6. Frequency characteristics of line and receiver weightings.

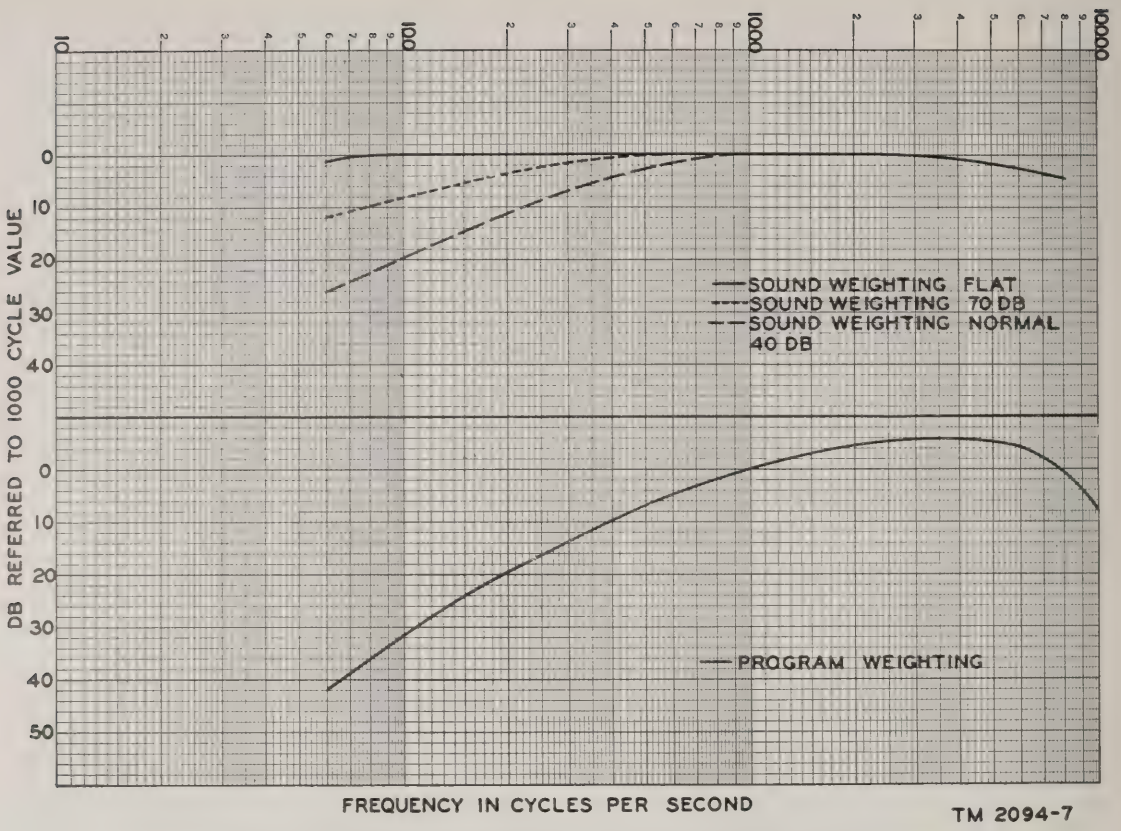


Figure 7. Frequency characteristics of program and sound weightings.

d. Operate switch K4 to the 144 position.

e. Insert the input plug in the BRDG jacks, and dummy plugs in the SOUND jacks.

f. Insert dummy plugs in the VOL jacks, which will reduce the input level by 30 db.

g. The transmission level of a 600-ohm circuit is measured directly in dbm by applying the calibration constant of −65 to the db-dial setting plus the meter reading. The range of the instrument for this test is from −55 to +20 dbm.

33. Use as Flat Amplifier

The set is used as a flat amplifier by the following procedure:

a. Operate switch K3 to the FLAT position.

b. Operate switch K4 to the 144 position.

c. Operate switch K1 to the FIL position.

d. Insert the input plug in the SOUND jacks.

e. Connect the input circuit to the IN binding posts.

f. Connect the output of the measuring set to binding posts EXT and MON REC GND.

Note. Use of the SOUND input circuit, which does not include an input coil, will give an essentially flat frequency-gain characteristic (fig. 7). Use of the other input circuits will involve one or both transformers T3 and T4, which will change the frequency characteristics.

34. Impedance Corrections

When the circuit impedance differs from the 600 ohms normally used with the LINE input circuit, a reflection loss correction must be added to the noise readings. An impedance correction must also be included when the BRDG or VOL input circuit is bridged across an impedance differing materially from 600 ohms. The impedance corrections are given in the following chart.

Circuit impedance	LINE	BRDG	VOL
1,200 ohms	+.5 db	—2.5 db	—3 db.
2,000 ohms	+1.5 db	—4.0 db	—5 db.

35. Purpose and Use of Equipment Performance Checklist

a. General. The equipment performance checklist (par. 36) aids in determining whether the measuring set is functioning properly. This checklist gives the item to be checked, the action or condition under which it is checked (what should happen), the normal indications of correct operations, and corrective measures the operator may take.

b. Action or Condition. For some items, the information consists of various switches and control settings under which the items are checked. For other items, it represents an action that must be taken to check the normal indications.

c. What Should Happen. The normal indications listed include the visible signs that the operator will find when the items are checked.

d. What To Do. When normal indications are not present, the operator may perform the corrective measures listed. If corrective measures do not yield results, trouble shooting (pars. 52 and 53) may be necessary.

36. Equipment Performance Checklist

		Item	Action or condition	What should happen	What to do
PREPARATORY	1	Battery (BA–23)	Pull up filament switch K2. Operate switch to FIL position.	Meter indicates filament voltage.	Check battery connections.
			Adjust FIL RHEO dial.	Meter pointer rests on red mark.	Weak batteries; replace.
	2	Battery (BA–2)	Operate switch K1 to PLATE position.	Meter pointer at or beyond red mark.	Weak batteries; replace.
START	3	CAL ADJ resistor. (R41).	Set db dial on 40. With screw driver, adjust CAL ADJ resistor.	Meter pointer rests on red mark.	Check battery (BA–23); replace if necessary. Check tube; replace defective one.
EQUIP. PERF.	4	Db dial	Increase or decrease meter deflection.	Meter indicates corresponding change.	Defective attenuator; repair or replace.
	5	Meter	No input to set or a steady input.	Meter should not show intermittent deflection.	Because of microphonic noise in tubes, loose connection, poor contact in plug, cord, or IN binding post. Correct defective part.
STOP	6	Battery supply switch K2.	Depress switch	Meter needle returns to off-scale position.	Defective switch; repair or replace.

37. Operation Under Unusual Conditions

If Transmission Measuring Set TS–559A/FT is used under severe climatic conditions such as prevail in tropical, arctic, or desert regions, the same precautions that apply to the equipment under test will apply to the test set.

a. Arctic Climates. If noise measurements are made at very low temperatures, readings made on the upper half of the scale are more accurate than those on the lower half.

b. Dessert Climates. In desert areas or other dusty atmospheres, protect the equipment from sand or dust by keeping it covered when not in use. If the equipment is uncovered, the jacks may be protected by plugging them with dummy plugs when the set is not operating.

CHAPTER 3
MAINTENANCE INSTRUCTIONS

Section I. LUBRICANTS AND PRESERVATIVES

38. Lubrication Instruction

The only component in the set requiring lubrication is attenuator AT1 (fig. 4). This should be cleaned and lubricated at 6-month intervals under normal operating conditions. It is not necessary to remove the attenuator from the set. Proceed as follows:

a. Loosen the four screws which hold the panel in the case.

b. Lift out the panel and rest it on the two panel handles (fig. 1).

c. Press the button on the side of the attenuator and lift off the cover.

d. Wipe the contacts with a clean cloth to remove old grease and dirt.

e. Apply a light coating of oil, lubricating, preservative, special (PL-Special) to contact surfaces.

f. Replace the attenuator cover.

39. Weatherproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained fully in TB SIG 13 and TB SIG 72.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained fully in TB SIG 66 and TB SIG 219.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained fully in TB SIG 75.

e. Lubrication. The effects of extreme cold and heat on materials and lubricants are explained in TB SIG 69. Observe all precautions outlined therein when operating equipment under conditions of extreme cold or heat.

f. Treating Equipment After Repairs. If the coating of protective varnish has been punctured or broken during repair, brush-coat the affected part. Be sure the break is sealed completely.

Section II. PREVENTIVE MAINTENANCE SERVICES

40. Definition and Importance of Preventive Maintenance

a. Preventive maintenance is a systematic series of checks and adjustments at regular intervals to keep equipment at the highest efficiency. Its purpose is to *prevent* breakdowns and, therefore, the need for repairs. The purpose of trouble shooting and repair is to locate and *correct existing defects.*

b. Preventive maintenance is of utmost importance, because the usefulness of a communication system depends on its operating efficiency, which is determined by efficient test equipment. Refer to TB SIG 123 for preventive maintenance practices.

41. Preventive Maintenance Tools and Materials

Before starting preventive maintenance procedures, have on hand all tools and materials

needed in performing the operations listed in the preventive maintenance checklist (par. 42). The following maintenance tools and materials may be secured through regular supply channels:

Common hand tools.
Burnisher, contact.
Cheesecloth, lint-free.
Crocus cloth.
Oil, lubricating, preservative, special (PL-Special).
Solvent, dry-cleaning (SD).

Note. Gasoline will not be used as a cleaning fluid.

42. Preventive Maintenance Checklist

Item No.	What to check	When to check	How to check	Precautions
1	Panel	Daily	Inspect for damage, dirt, dust, and loose or missing screws. Wipe with clean cloth slightly moistened with solvent (SD) to remove oil, grease, or foreign matter. Wipe with dry cloth.	Tighten screws snugly; never force them. Remove traces of lint.
2	Input cord and plug.	Weekly	Inspect cord for dirt, dust, and mildew. Inspect plug for corrosion and loose connections. Clean cord with a clean, dry cloth. If grease is on the cord, clean with solvent (SD). Tighten plug connections with a screw driver.	Never use soap and water when cleaning cord and plug.
3	Controls	Weekly	Inspect for freedom of action. See that only a normal amount of force is required to operate them. Be certain that knobs are not loose.	Do not overtighten screws holding the knobs.
4	Binding posts	Weekly	Check for loose connections	Tighten snugly; do not use force.
5	Interior and batteries.	Weekly	Remove panel. Inspect batteries for corrosion and swelling. See that battery retaining strips are firmly in place. Check for loose connections. Blow dust or dirt from interior with air hose.	When cleaning the interior, direct the first blast of air away from the set toward the floor to clear the line of accumulated moisture. If batteries are removed when cleaning the interior, be sure to check polarity when replacing. Replace retaining strips.
6	Chassis	Monthly	Inspect wiring and other parts for excessive wear. Check contacts of keys and switches for dirt, dust, or foreign matter. Look for corrosion and rust. See that all solder joints are secure. Check screws, nuts, and bolts. Tighten screw-type terminals.	Do not overtighten screws, nuts, or bolts. When soldering, be sure that solder particles do not fall between the parts.
7	Attenuator AT1	Semiannually	Wipe switch contacts with clean cloth	Remove all traces of lint after cleaning.

CHAPTER 4

FIELD MAINTENANCE INSTRUCTIONS

Section I. THEORY OF OPERATION

43. General Functioning of Equipment

Transmission Measuring Set TS–559A/FT is designed primarily to measure noise magnitudes of 10 to 85 db below reference level at frequencies up to 10,000 cycles.

a. The input circuit, consisting of input coils and switching arrangements, facilitates the various types of measurements possible with this set.

b. Weighting networks for frequency discrimination permit noises of different frequencies to be measured in terms of their interfering effects.

c. Attentuator AT1 at the input of the amplifier makes it possible to measure a wide range of noise amplitudes. A 30-db pad is provided to extend the measuring range when necessary.

d. The amplifier raises the level of the noise currents sufficiently to operate the indicating meter.

e. The amplified alternating currents are rectified, by means of germanium crystals, for measurement on d-c milliammeter M1, which is calibrated in db.

f. Calibration is accomplished by the feedback circuit which is connected between the output of the amplifier circuit and the input of equalizer network EQ1.

44. Input Circuits

a. The input circuits most frequently used with the various weightings are shown schematically in figures 8, 9, and 10. Input transformer T3 is a 600— to 600-ohm impedance line coil, balanced to ground. Input transformer T4 is a 6,000— to 600-ohm impedance line coil, balanced to ground and used only in the BRDG circuit ahead of transformer T3. Blocking capacitors C1 and C2 are provided in all input circuits, except the SOUND and VOL circuits, to protect the set from d-c potentials of ordinary amounts. In addition, resistors of varying values as shown for the various inputs present the proper impedance for the circuit under test.

b. Table I lists the switches and jacks used for the various combinations of input circuits and weightings.

c. Equalizer EQ1 provides the various networks which are used in combination with the interstage amplifier characteristics to provide the required frequency weighting. An additional network, consisting of reactor L1, capacitors C12 and C14, and resistors R38 and R39, is associated with switch K4 and provides the frequency weightings required for use with HA1 receivers.

d. Attenuator AT1 is a bridged T pad, variable in 12 steps of 5 db each. This bridged T type of network provides a fixed 600-ohm input and output impedance over the entire range. An additional 30-db fixed pad, comprising R34, R35, and R36, is provided by inserting dummy plugs in the VOL jacks. Use of the pad extends the measurable range for all input circuits except the VOL circuit.

45. Amplifier

a. The audio amplifier, which consists of three stages of voltage amplification, uses three type IU4 electron tubes: V1, V2, and V3. The line-to-grid transformer T1, at the input of the amplifier, is unbalanced to ground. The amplifier is resistance-capacitance coupled, the values being such as to produce the frequency characteristics required for sound weighting measurements. Switch K3 controls the three available sound weightings, namely: flat, normal, and 70 db.

(1) In the NORMAL switch position, the values of the resistance-capacitance coupling between the amplifier stages provide the frequency characteristics required for measurements of moderate sounds.

(2) In the 70 DB switch position, the weighting provided by the coupling between amplifier stages 1 and 2 is removed.

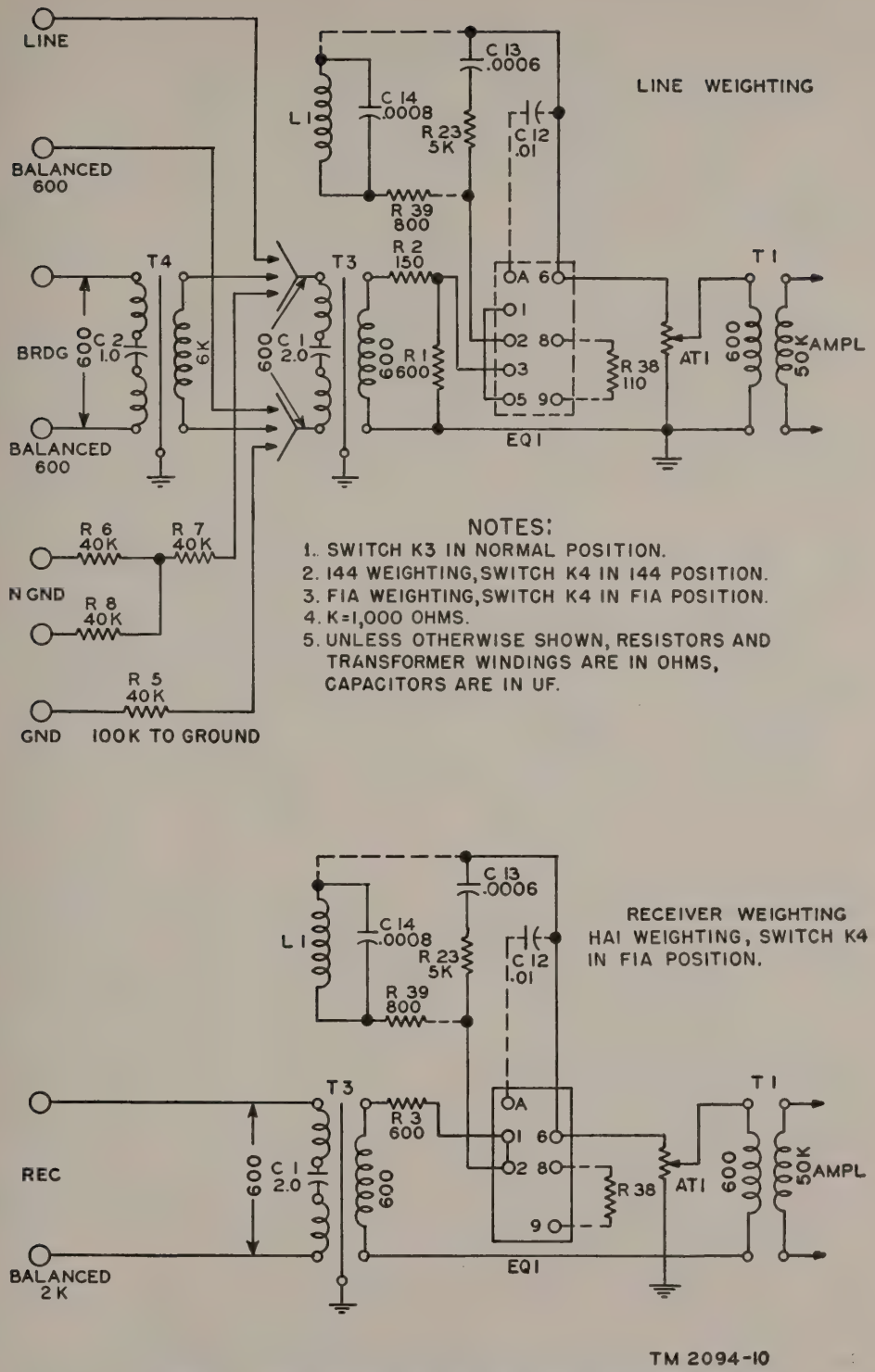


Figure 8. Inputs obtainable with line and receiver weightings.

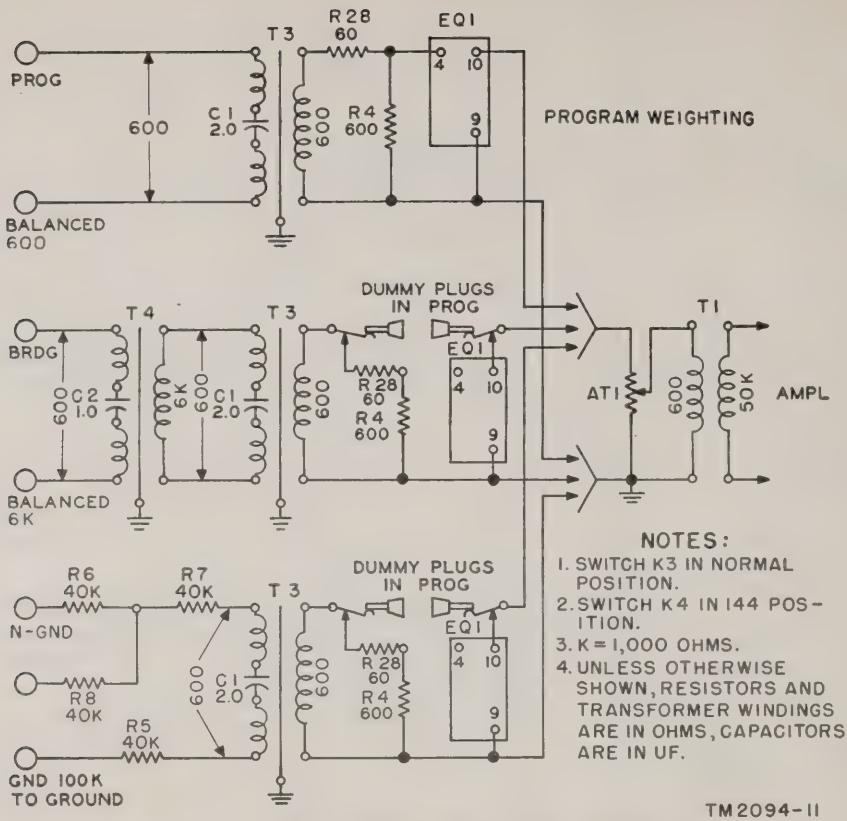


Figure 9. Inputs obtainable with program weighting.

(3) With switch K3 in the FLAT position, the weightings provided by the coupling between amplifier stages 1 and 2, and between stages 2 and 3, are removed, providing a nearly flat gain-frequency amplifier.

b. The output of the amplifier circuit includes a feedback circuit which is used for calibration when the input plug is inserted in the CAL jacks and switch K4 is operated to the 144 position. This circuit consists of varistor CR3, resistor R42, and resistors R37 and R11, which are wired to the CAL jacks to form a bridged T feedback circuit between terminal 1 of transformer T2 and resistor R2 associated with 144 line weighting and terminal 3 of equalizer EQ1. The ground point is connected to the case of the set. Since the gain of the set is considerably greater at 1,000 cycles than at any other frequency, the feedback circuit causes the amplifier to sing at approximately the frequency of peak response. The magnitude of this sing is controlled by varistor CR3, so that a definite reading may be obtained in the meter and the amplifier gain is set to the value as given on figure 13. The two portions of the varistor are connected to provide temperature compensation. The primary adjustment of the calibration circuit is given in paragraph 55.

c. Resistor R29 (39,000 ohms) is in series with the MON REC binding post. The function of this resistor is to reduce the sensitivity of the high-impedance monitor-receiver to radio-frequency induction.

46. Meter Circuit

Meter M1 in the output circuit is a d-c milliammeter with a full-scale deflection of about 300 ua; the scale is graduated in db. A bridge-type rec-

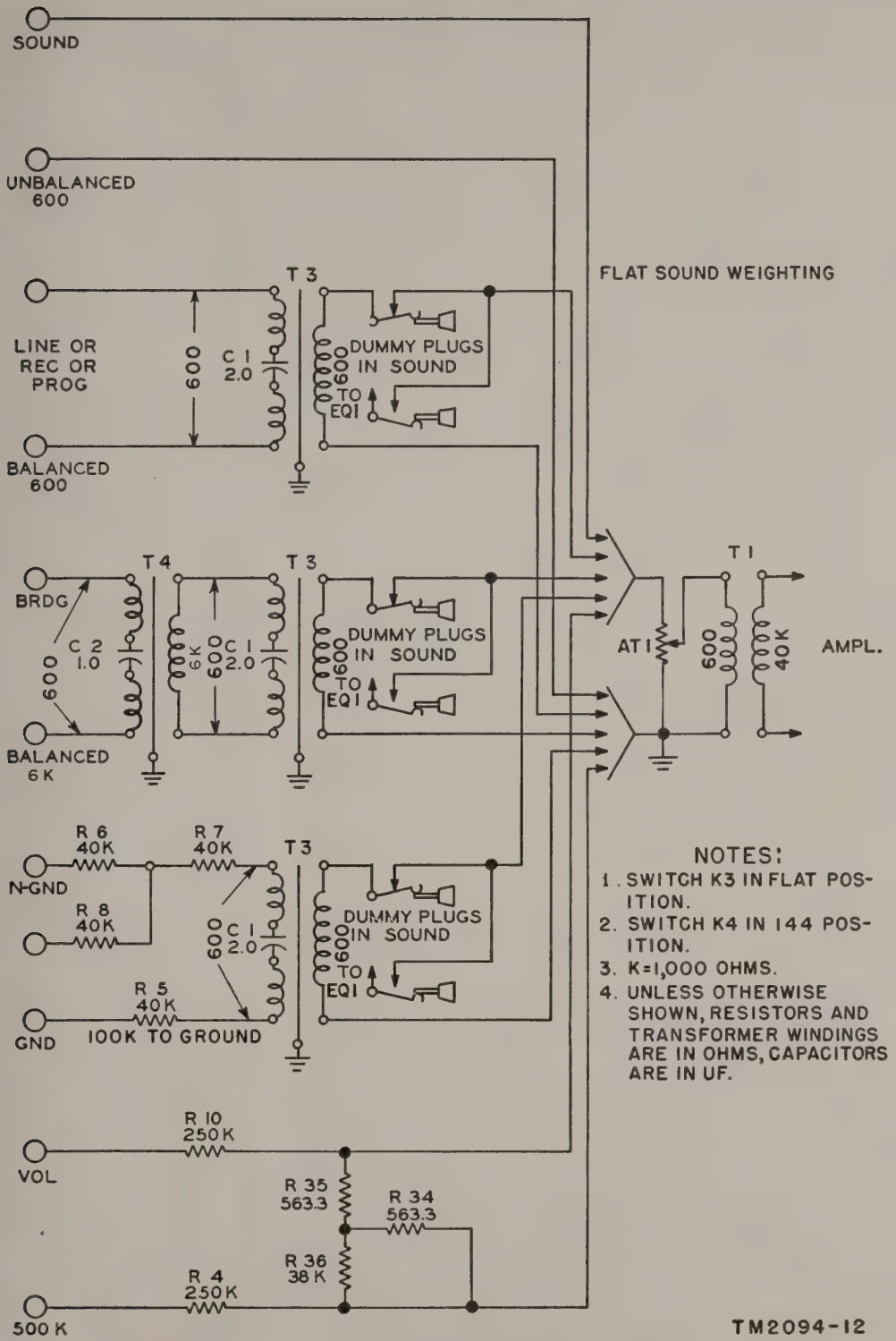


Figure 10. Inputs obtainable with flat sound weighting.

tifier, which consists of two rectifier crystals CR1 and CR2, rectifies the amplified alternating currents. Capacitor C9, bridging the high-resistance meter, is charged by the peaks of rectified current which are discharged partially between peaks, and thus contributes to the meter reading.

Section II. TEST AND REPAIR EQUIPMENT

47. Tools and Materials

The tools and materials required for adjusting, cleaning, and repairing Transmission Measuring Set TS–559A/FT are listed below:

Tool or material	Use
Brush, paint: soft hair; flat	Removes dust and dirt from switches and interior of equipment.
Burnisher: contact	Cleans contact surfaces.
Pliers: special long-nosed	Tighten loose wire connections.
Screw driver	Tightens screws.
Carbon tetrachloride	Cleans various parts.
Solvent, dry-cleaning (SD)	Cleans panel.

48. Test Equipment

Transmission Measuring Set TS–559A/FT can, in general, be tested adequately by use of the equipment and apparatus listed below:

Test equipment	Power source	Use
Attenuator TS–402/U	None	Used in test circuit.
Signal Generator SG–15/PCM	115 to 125 v, 60 cyc a-c	Provides signal for test purposes.
Tube Tester I–177	105 to 125 v, 60 cyc a-c	Check electron tubes.
Multimeter TS–297/U	Internal battery	Test shorted capacitors.
Multimeter TS–352/U	Internal battery	Check resistors.
Repeating coil 600 to 600 ohms	None	Isolation tests.
Repeating coil 600 to 200 ohms	None	Impedance matching.
Repeating coil 600 to 135 ohms	None	Impedance matching.
Transmission Measuring Set TS I–61	Dry battery	Check input level.

Section III. INSPECTING, ADJUSTING, AND CLEANING

49. Inspecting

Make a visual inspection of the equipment when it is turned in for repair. Analyze the extent of the necessary repair and determine whether the condition of the equipment warrants repair. Two factors must be considered: whether the replacement and repair of major parts justify the work involved, and the urgency of returning the equipment to service. If there is an urgent need for the equipment and a replacement is not available, the work involved is justified. If the need is not urgent and the repair involved amounts to a rebuilding operation with the replacement of many parts, salvage the equipment. If salvaged, strip and place the usable parts in stock for reuse.

50. Adjusting

Defective parts of Transmission Measuring Set TS–559A/FT can be removed readily for repair, adjustment, or replacement. When replacement of a part requires disconnection of wires, tag each wire to assure correct rewiring.

51. General Cleaning

a. Clean the outside of the equipment with a lint-free cloth. Remove dirt with a cloth moistened with clean water and wipe dry with a clean, lint-free cloth.

b. Remove the cover of the case. Clean the panel with a lint-free cloth. Remove grease or dirt with a cloth dampened with solvent (SD). Wipe with a clean, dry cloth.

c. Remove the chassis from the case and rest it on the handles. Use a soft bristle brush to remove accumulated dust, dirt, and other foreign matter.

Section IV. TROUBLE LOCATION

52. Preliminary Procedure for Locating Trouble

a. Before attempting to locate trouble in Transmission Measuring Set TS–559A/FT, make a visual inspection of the equipment for signs of damage, such as loose mounting screws, nuts or bolts, loose or poorly soldered connections, dirty switch contacts, overheated resistors, damaged insulation, and exposed wiring. Figures 4 and 5 will aid in locating most of the parts.

b. Read the theory of operation (pars. 43 through 46). Refer to the trouble-shooting chart (par. 53), the schematic diagram (fig. 12), and diagrams of obtainable input circuits shown schematically (figs. 8, 9, and 10).

c. Sectionalize the trouble as far as possible.

(1) If the trouble is apparent in all operations, check those parts involved, such as the meter, vacuum tubes, batteries, and attenuator.

(2) If the trouble appears only when using a specific input, check the associated jacks and input circuit.

(3) If the trouble is apparent only when calibrating the measuring set, check the battery supply switch K2, CAL jacks, and calibrating circuit.

(4) Check the resistances as given on the schematic diagram (fig. 12).

(5) To check the parts in the amplifier circuit, remove the two screws which secure the amplifier chassis (fig. 4) to the main assembly.

53. Trouble-shooting Chart

Action	Condition	Possible trouble	What to do
Pull up FIL switch K2	Filaments heat up	Defective FIL switch K2 Defective battery switch.	Check switches and wiring.
Operate switch K1 to PLATE	Plate voltage indicates below the red mark on the meter.	Loose battery connections Worn out battery	Check battery connections. Test batteries; replace if necessary.
Operate switch K1 to FIL	Filament voltage cannot be adjusted to the red mark on the meter.	Worn out battery	Test batteries; replace if necessary.
Rotate FIL RHEO	Meter needle fails to move	Defective battery switch K1 FIL RHEO (R47) or resistor R27 open. Tubes V1, V2, or V3	Check switch and wiring. Check and replace, if necessary. Check and replace, if necessary.
Adjust CAL ADJ	Meter needle cannot be adjusted to the red mark.	CAL ADJ R41, R42, R11, or R37. Defective CAL jacks. Input plug.	Check for open, short, or poor connections.
Primary calibration	Internal calibration does not check with external calibration.	Varistor CR3 Resistor R2.	Check for open, short, or poor connections; replace if necessary.
SOUND WTG switch K3 in FLAT position.	Frequency characteristics do not check with curve.	Capacitors C10 and C11 Resistor R30, R31, R32, or R33.	Check for open, short, or poor connections; replace if necessary.
SOUND WTG switch K3 in 70 DB position.	Frequency characteristics do not check with curve.	Capacitor C10 Resistor R30 or R31.	Check for open, short, or poor connections; replace if necessary.

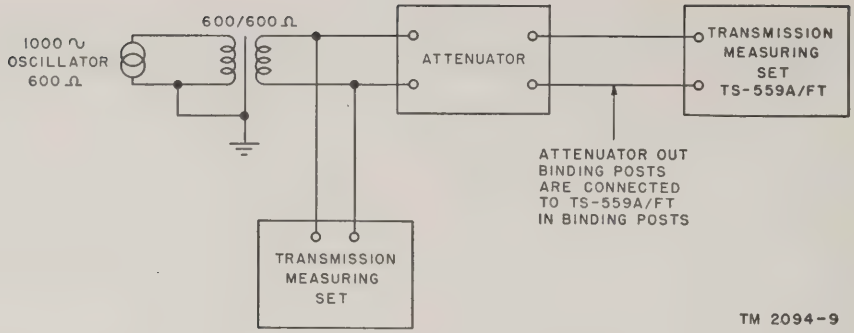


Figure 11. Test circuit for checking primary calibration of Transmission Measuring Set TS–559A/FT.

54. Primary Calibration

Transmission Measuring Set TS–559A/FT is calibrated correctly by the manufacturer prior to delivery for use. This primary calibration, which is controlled by resistor R42, requires careful checking about every 6 months. Resistor R42 is reached for adjustment through a hole in the control panel located to the left of the meter case. The hole is covered by a button-plug (partially concealed in figure 1). A test circuit for checking calibration (fig. 11) generally requires the following equipment: an oscillator, supplying 1,000-cycle power into a 600-ohm load (*h* below); a 600-ohm to 600-ohm repeating coil (not required if the oscillator used is equipped with a shielded repeating coil in the output circuit); a transmission measuring set, to measure and assure a proper input level (*i* below); and an attenuator, adjusted to an output of 600 ohms. To check calibration, proceed as follows:

a. Turn on the filament supply by pulling out switch K2.

b. Operate switch K1 to the FIL position and adjust the filament voltage by operating the FIL RHEO dial until the meter needle rests on the red mark.

c. Operate switch K1 to the PLATE position and note that the meter needle indicates beyond the red mark.

d. Operate switch K1 to the NORMAL position and allow the set to warm up for 10 minutes.

e. After this warm-up period, readjust the filament voltage and recheck battery voltage.

f. With switch K1 in the NORMAL position, insert the input plug in the LINE jacks.

g. Set the db dial on 45 and operate switch K4 to the 144 position.

h. Connect the test circuit (fig. 11) to the IN binding post (Transmission Measuring Set TS–559A/FT). Attenuation setting should be −40 db.

i. Set the oscillator frequency dial to 1,000 cycles. Adjust the output of the oscillator to give a reading of 0 level at the input of the attenuator (fig. 11).

j. With a screw driver, adjust the CAL ADJ resistor until the meter needle rests on +5.

k. Remove the input plug from the LINE jacks and insert it in the CAL jacks.

l. Set the db dial to 40.

m. Remove the button-plug and adjust resistor R42 until the meter needle rests on the red mark.

n. Reset the db dial to 45.

o. Remove the input plug from the CAL jacks and reinsert it in the LINE jacks. If the +5 reading on the indicating meter checks, the primary calibration of the set is correct.

p. Replace the button-plug covering R42.

q. If the external and internal calibrations do not agree, check the following parts:

(1) Check the CAL jacks.

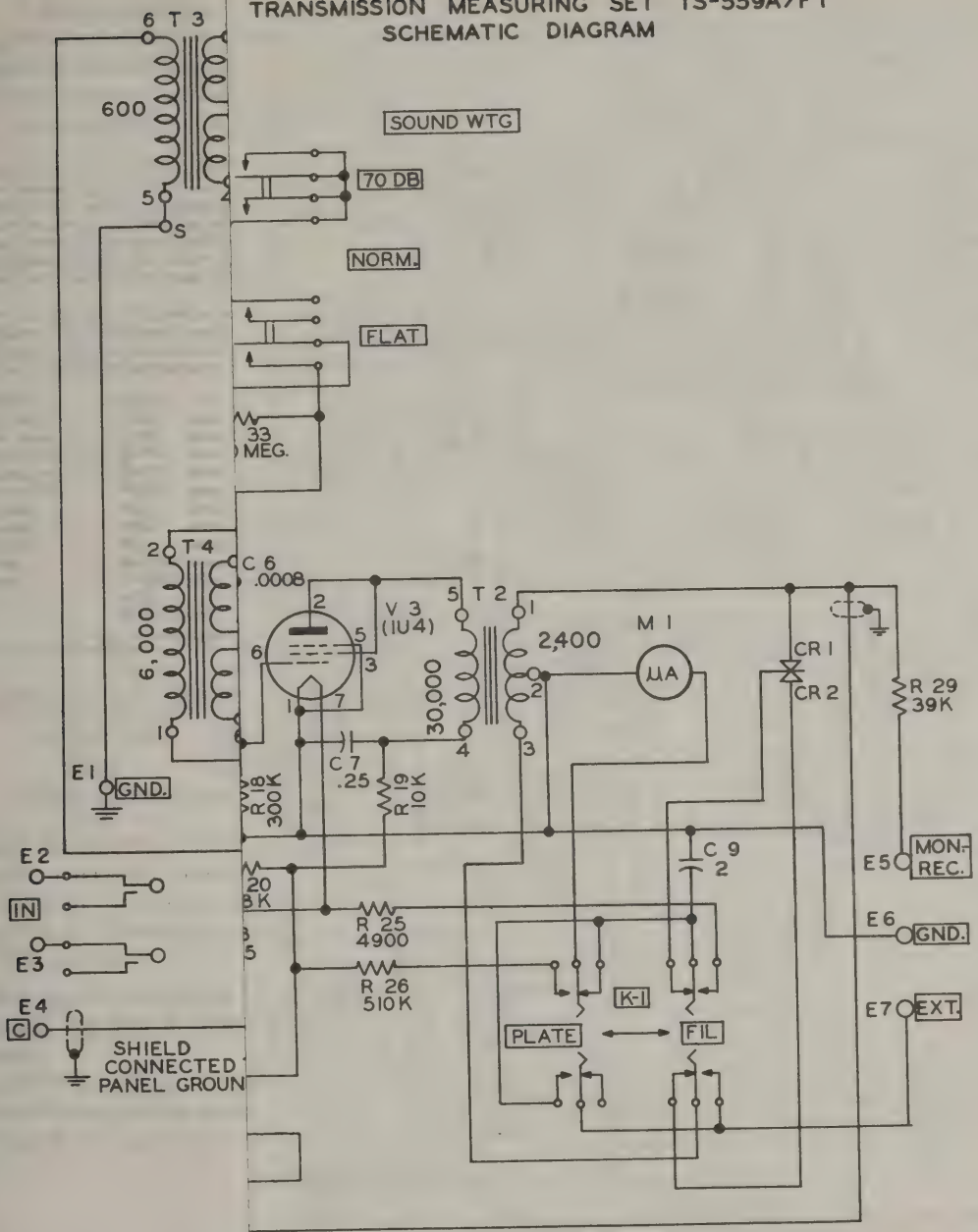
(2) Check resistors R42, R11, and R37 for possible opens, shorts, or loose connections. Replace defective resistors.

(3) Failure of the internal circuit to function properly when external power is used in calibrating may be traced to varistor CR3 or resistor R2 trouble. Refer to the trouble-shooting chart (par. 53).

55. Check of Frequency Characteristics

Check the frequency characteristics of the set about every 6 months, even though trouble is not

TRANSMISSION MEASURING SET TS-559A/FT
SCHEMATIC DIAGRAM



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520472 (3942A) O-60 (Face p 24)

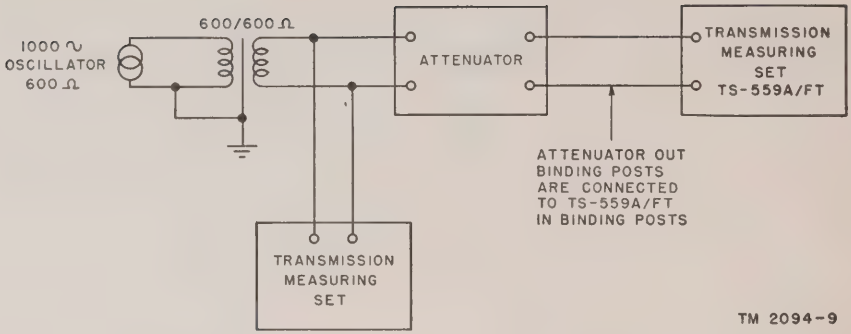

Figure 11. Test circuit for checking primary calibration of Transmission Measuring Set TS–559A/FT.

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a. Turn on the filament supply by pulling out switch K2.

b. Operate switch K1 to the FIL position and adjust the filament voltage by operating the FIL RHEO dial until the meter needle rests on the red mark.

c. Operate switch K1 to the PLATE position and note that the meter needle indicates beyond the red mark.

d. Operate switch K1 to the NORMAL position and allow the set to warm up for 10 minutes.

e. After this warm-up period, readjust the filament voltage and recheck battery voltage.

f. With switch K1 in the NORMAL position, insert the input plug in the LINE jacks.

g. Set the db dial on 45 and operate switch K4 to the 144 position.

h. Connect the test circuit (fig. 11) to the IN binding post (Transmission Measuring Set TS–559A/FT). Attenuation setting should be −40 db.

i. Set the oscillator frequency dial to 1,000 cycles. Adjust the output of the oscillator to give a reading of 0 level at the input of the attenuator (fig. 11).

j. With a screw driver, adjust the CAL ADJ resistor until the meter needle rests on +5.

k. Remove the input plug from the LINE jacks and insert it in the CAL jacks.

l. Set the db dial to 40.

m. Remove the button-plug and adjust resistor R42 until the meter needle rests on the red mark.

n. Reset the db dial to 45.

o. Remove the input plug from the CAL jacks and reinsert it in the LINE jacks. If the +5 reading on the indicating meter checks, the primary calibration of the set is correct.

p. Replace the button-plug covering R42.

q. If the external and internal calibrations do not agree, check the following parts:

(1) Check the CAL jacks.

(2) Check resistors R42, R11, and R37 for possible opens, shorts, or loose connections. Replace defective resistors.

(3) Failure of the internal circuit to function properly when external power is used in calibrating may be traced to varistor CR3 or resistor R2 trouble. Refer to the trouble-shooting chart (par. 53).

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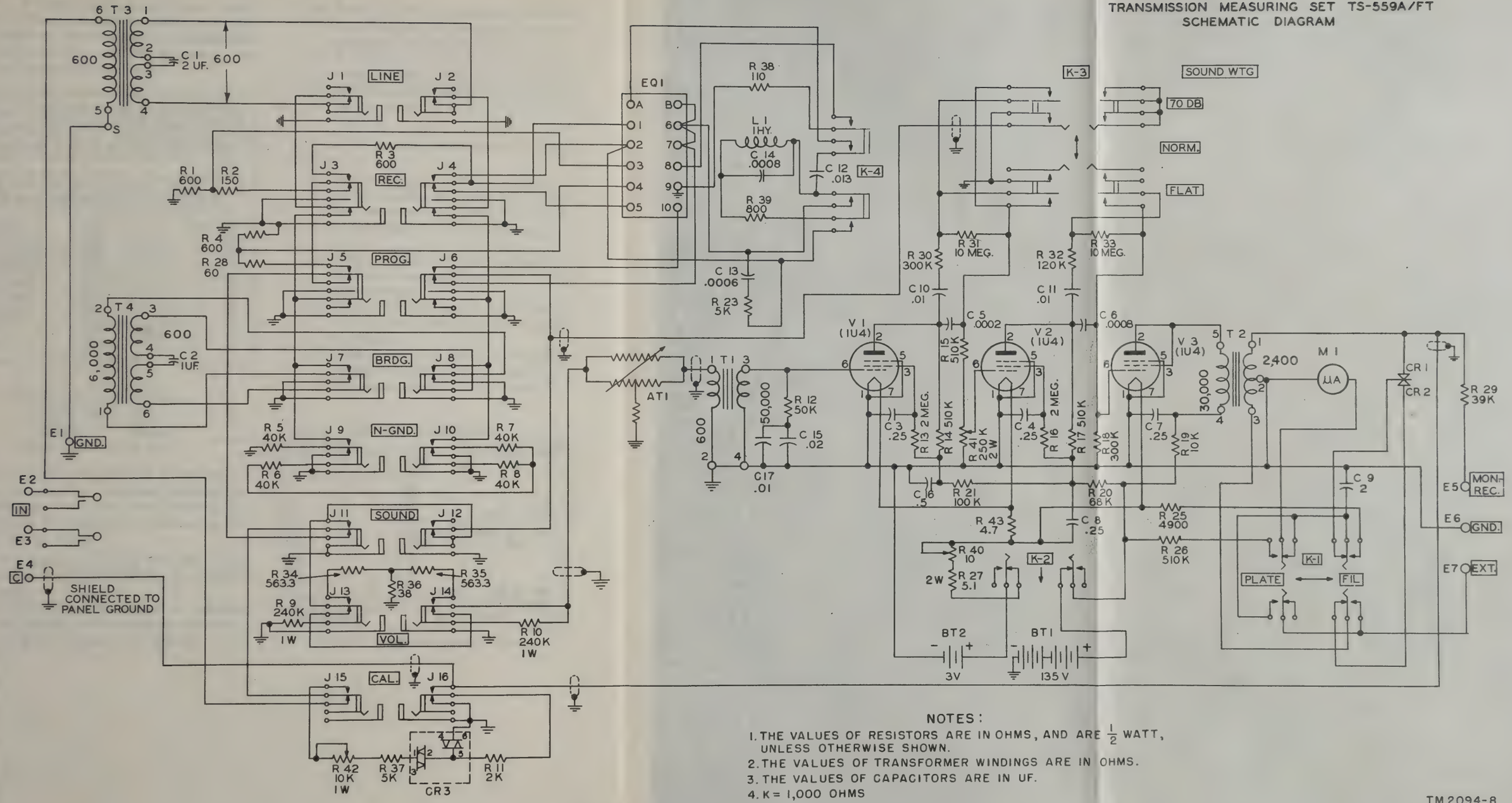
Check the frequency characteristics of the set about every 6 months, even though trouble is not

TRANSMISSION MEASURING SET TS-559A/FT
SCHEMATIC DIAGRAM



NOTES:

1. THE VALUES OF RESISTORS ARE IN OHMS, AND ARE $\frac{1}{2}$ WATT, UNLESS OTHERWISE SHOWN.
2. THE VALUES OF TRANSFORMER WINDINGS ARE IN OHMS.
3. THE VALUES OF CAPACITORS ARE IN UF.
4. K = 1,000 OHMS

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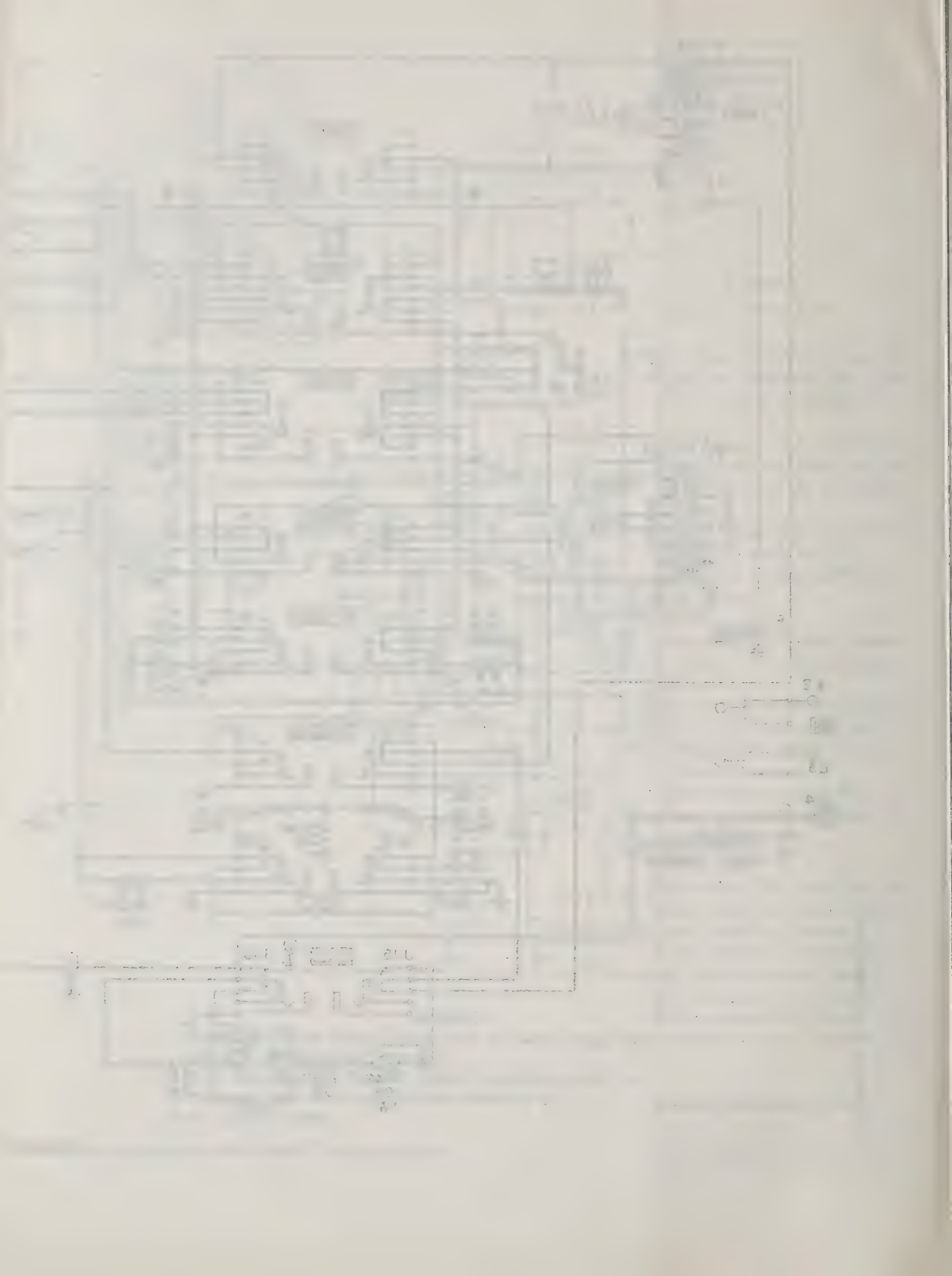
Figure 12. Transmission Measuring Set TS-559A/FT, schematic diagram.



apparent. A frequency check can be coordinated with the primary calibration check (par. 54). Check frequency characteristics by sending definite amounts of power at various frequencies into each of the input circuits (table I).

CALIBRATION---TURN ON FIL AND WAIT 1 MIN. WITH K1 ON FIL ADJUST METER NEEDLE TO RED LINE BY FIL RHEO. THROW K1 TO PLATE (IF BELOW RED LINE IN EITHER CASE REPLACE BATTS. BEING TESTED). WITH PLUG IN CAL JACKS (OTHER JACKS EMPTY) K1 AND K3 NORMAL, AND K4 ON 144 SET DB DIAL TO 40 AND ADJUST CAL ADJ UNTIL NEEDLE RESTS ON RED LINE. REMOVE PLUG FROM CAL JACKS.

MEASUREMENT---SET DB DIAL AT 75 AND K1 NORMAL. CONNECT SET TO CKT TO BE TESTED. MAKE RECORD OF JACKS USED AND OF KEY SETTINGS. ADJUST DB DIAL TO OBTAIN CONVENIENT METER DEFLECTION. ADD METER AND DIAL READINGS TO APPROPRIATE CONSTANT BELOW.

QUANTITY	JACKS	K3	K4	CONST.	FOR
MESSAGE CIRCUIT NOISE	LINE	NORM.	144	0	DBA
MESSAGE CIRCUIT NOISE	LINE	NORM.	F1A-HA1	+7	DBA
MESSAGE NOISE, BRIDGING CKT.	BRDG.	NORM.	144	+11	DBA
MESSAGE NOISE, BRIDGING CKT.	BRDG.	NORM.	F1A-HA1	+18	DBA
PROGRAM CIRCUIT NOISE	PROG.	NORM	144	0	DBRN
144 RECEIVER NOISE	REC.	NORM.	144	0	DBA
587 RECEIVER NOISE	REC.	NORM.	144	+5	DBA
HA1 RECEIVER NOISE	REC.	NORM.	F1A-HA1	+7	DBA
NOISE TO GROUND	N-GND.	NORM.	144	0	DBA
NOISE TO GROUND	N-GND.	NORM.	F1A-HA1	+7	DBA
VOLUME	VOL.	FLAT	144	-43	VU
SOUND LEVEL	SOUND	*	144	*	*

* SEE INSTRUCTIONS

NOTE:
WORDS IN THIS INSTRUCTION CARD WHICH ARE SYNONOMOUS WITH WORDS IN THE TEXT ARE:

INSTRUCTION CARD	TEXT
KEY	SWITCH
MESSAGE	AUDIO
RED LINE	RED MARK

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Figure 13. Instruction card.

a. The test circuit (fig. 11) may be used for the frequency characteristics, provided that the output impedance of the test circuit matches the various inputs to Transmission Measuring Set TS–559A/FT, as follows:

(1) Test circuit output of 600 ohms is required for LINE, BRDG, or SOUND input.

(2) A 600− to 200-ohm impedance matching transformer will be required when measuring REC input 144 weighting.

(3) A 600− to 135-ohm impedance matching transformer will be required when measuring REC input F1A weighting.

(4) A 600-ohm loading resistor is required when measuring BRDG or VOL input.

(5) Use a balanced H attenuator for balanced inputs and a T type for unbalanced inputs.

b. To check frequency characteristics, proceed as follows:

(1) Follow the test procedure outlined for primary calibration (par. 54) to check the frequency characteristics for the LINE input and 144 weighting at 1,000 cycles.

(2) Hold the input level constant and check the loss at various points over the frequency range.

(3) Compare the results of these readings with the curve shown for 144 line weighting (fig. 6).

(4) Other inputs and frequency weightings should be checked and compared with their respective curves (figs. 6 and 7).

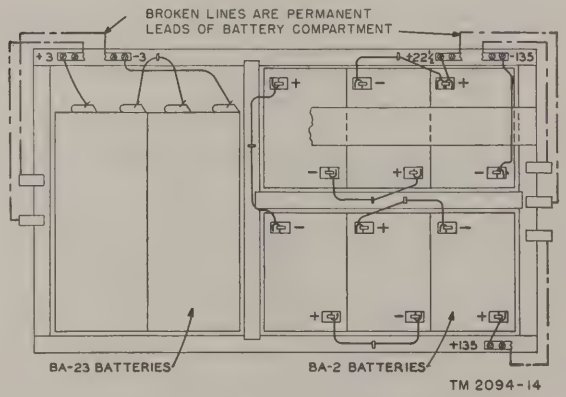

Figure 14. Battery connections, diagram.

CHAPTER 5

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

56. Disassembly

The following instructions are recommended as a general guide for preparing Transmission Measuring Set TS–559A/FT for transportation and storage.

a. Place the monitor-receiver in its compartment (fig. 3) and slide the cover into position.

b. Remove any leads connected to the binding posts.

c. Insert the input plug in the LINE jacks.

d. Place the dummy plugs in the holder.

e. Disconnect and remove the batteries from the battery compartment and replace the retaining strips.

f. Replace the front panel and fasten it to the case.

g. Fasten the cover of the set to the carrying case.

57. Packaging Transmission Measuring Set TS–559A/FT

Cushion the set on all surfaces with cells or pads fabricated of corrugated fiberboard. Obtain the proper amount of desiccant, as prescribed in table II, section E of Joint Army-Navy Specification JAN–P–116, and place the cushioned set, together with technical manuals and desiccant, within a close-fitting, slotted, corrugated fiberboard box. Seal the entire closure with gummed tape and blunt all corners of the box. Place the boxed set within a moisture-vaporproofed barrier, and heat-seal the closure. Place the moisture-vaporproofed set within a second close-fitting, slotted, corrugated fiberboard box and seal the entire closure with water-resistant tape or adhesive. Overwrap the boxed set in waterproof barrier material. Completely seal all joints, seams, and closures with adhesive or other suitable seal equal in moisture resistance to that of the body material, in accordance with approved specifications.

58. Packing and Marking

Materials used in packing described in *a* and *b* below should comply with requirements in Joint Army-Navy Specification JAN–P–100.

a. Place the equipment, packaged as described in paragraph 57, within a nailed wooden box lined inside with a 2-inch thickness of excelsior compacted to 3 pounds per cubic foot. The shipping container should *not* be lined with a waterproof bag.

b. For oversea shipment only, the shipping container should be strapped in accordance with approved specifications.

c. Signal Corps depots should mark interior packages in accordance with Signal Corps Instruction No. 726–15, and shipping containers in accordance with Signal Corps Instruction No. 720–14.

Section II. DEMOLITION TO PREVENT ENEMY USE

59. General

The demolition procedures outlined in paragraph 60 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished *only* upon order of the commander.

60. Methods of Destruction

a. Smash. Smash panel and controls, capacitors, resistors, switches, dial, etc., using sledges, axes, handaxes, pickaxes, hammers, crowbars, and heavy tools.

b. Cut. Cut all wiring in electrical circuits, using axes, handaxes, and machetes.

c. Burn. Burn all instruction books, circuits, etc., using gasoline, kerosene, oil, flame throwers, and incendiary grenades.

d. Explode. If explosives are necessary, use firearms, grenades, or TNT.

e. Disposal. Bury or scatter the destroyed parts, and all remaining parts of this equipment, in slit trenches, fox holes, or other holes, or throw them into streams.

f. Destroy Everything. *Use anything immediately available for the destruction of this equipment.*

APPENDIX I

REFERENCES

Note.—For availability of items listed, check SR 310–20–3 for field manuals and JANAP's. Check SR 310–20–4 for technical manuals, technical bulletins, and supply bulletins.

1. Technical Manuals for Equipment Associated With Transmission Measuring Set TS–559A/FT

TM 11–346	Test Sets I–61–A, I–61–B, and I–61–C.
TM 11–2040	Oscillator TS–401/U (51 A (SPL) Oscillator).
TM 11–2044	Attenuator TS–402/U and TS–402A/U.
TM 11–2627	Tube Tester I–177 and I–177–A.
TM 11–2095	Transmission Measuring Set TS–568/FT.
TM 11–5500	Multimeter TS–297/U.

2. Packaging and Packing Instructions

a. Military (Joint Army-Navy) Specifications.

JAN–B–121	Barrier-materials, Greaseproof.
JAN–C–149	Compound, Protective, Strippable (hot dripping).
JAN–D–169	Desiccants (activated).
JAN–P–100	Packaging and Packing for Overseas Shipment—General Specification.
JAN–P–101	Packaging and Packing for Overseas Shipment—Adhesive, Water-Resistant, For Sealing Fiberboard Boxes.
JAN–P–102	Packaging and Packing for Overseas Shipment—Composition Top-coating Materials, Bituminous.
JAN–P–103	Packaging and Packing for Overseas Shipment—Boxes; Wood-Cleated; Solid Fiberboard.
JAN–P–104	Packaging and Packing for Overseas Shipment—Crates; Sheathed; Wood, Nailed.
JAN–P–105A	Packaging and Packing for Overseas Shipment—Boxes; Wood, Cleated, Plywood.
JAN–P–106A	Packaging and Packing for Overseas Shipment—Boxes; Wood, Nailed.
JAN–P–108	Packaging and Packing for Overseas Shipment—Boxes; Fiberboard (V-Board and W-Board), Exterior and Interior.
JAN–P–115	Packaging and Packing for Overseas Shipment—Compound, Sealing, Dip-coating.
JAN–P–116	Packaging and Packing for Overseas Shipment—Preservations, Methods Of.
JAN–P–117	Packaging and Packing for Overseas Shipment—Bags, Interior Packaging.
JAN–P–120	Packaging and Packing for Overseas Shipment—Cartons, Folding, Paperboard.
JAN–P–125	Packaging and Packing for Overseas Shipment—Barrier-Materials, Waterproof Flexible.
JAN–P–127	Packaging and Packing for Overseas Shipment—Tape, Adhesive, Pressure-Sensitive, Water-Resistant.
JAN–P–658	Packaging and Packing of Electrical Equipment and Spare Parts (electronic, electrical, and electro-mechanical).

b. U. S. Army Specification

100–2E	Marking Shipments by Contractors, Standard Specification For (and Signal Corps Supplement thereto).

c. Signal Corps Instructions

720–7	Standard Pack.
720–14	Depot Marking Manual.
726–15	Marking of Interior Containers (for Signal Corps Equipment).

3. Painting and Preserving

SB 11–76	Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.
TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 66	Winter Maintenance of Signal Equipment.
TB SIG 69	Lubrication of Ground Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 219	Operation of Signal Equipment at Low Temperatures.

4. Supply Publications

SB 11–47	Preparation and Submission of Requisitions for Signal Corps Supplies.

5. Demolition

FM 5–25	Explosives and Demolitions.

Other Publications

SR 310–20–3	Index of Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Graphic Training Aids, Joint Army-Navy-Air Force Publications, and Combined Communications Board Publications).
SR 310–20–4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.
SR 700–45–5	Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247).
SR 745–45–5	Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD–66 (Army), SandA–70–6 (Navy), and AF–MC–U2 (Air Force)).

APPENDIX II

IDENTIFICATION TABLE OF PARTS

Note.—The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as a specific T/O & E, T/A, SIG 7–8–10, SIG 10, list of allowances of expendable material, or other authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this manual is SIG 7 & 8–TS–559/FT. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1.

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	TEST SET, telephone: AN. Transmission Measuring Set TS–559A/FT; for measuring noise on telephone circuits; metal case, aluminum finish; 18″ wd x 10″ h x 11½″ d o/a; portable; range 10–85 db above reference noise; battery operated; monitoring receiver w/2–cond tinsel cord and plug attached.	Noise measuring set	3F4265
	TEST SET: bare unit for Transmission Measuring Set TS–559A/FT; without network items.		3F4265AZ
AT1	ATTENUATOR, variable: bridged *T* resistive type; impedance 600 ohms; ±1% input and output.	Provides a fixed 600-ohm input and output impedance over entire range.	2Z394.92
BT1	BATTERY, dry: 22.5 v; Sig C BA–2	Plate voltage supply	3A2
BT2	BATTERY, dry: 1.5 v; Sig C BA–23	Filament voltage supply	3A23
C1, C9	CAPACITOR, fixed: paper 2 μf ±10%; 600 vdcw; JAN CP70E1FF205K.	C1—Blocking capacitor provided in all input circuits, except VOL and SOUND, to protect the set against ordinary d-c potentials. C9—Charged by the peaks of rectified current and partially discharged between peaks in the meter circuit.	3DB2–130
C2	CAPACITOR, fixed: paper; 1 μf ±10%; 600 vdcw; JAN CP70E1FF105K.	Same as C1	3DB1–135.
C3, C4, C7, C8.	CAPACITOR, fixed: paper; 250,000 μμf ±10%; 600 vdcw; JAN CP61B1FF254K.	Audio-frequency bypass capacitors	3DA250–403.
C5	CAPACITOR, fixed: mica; 200 μμf ±2%; 500 vdcw; JAN CM20D201G.	Provides capacitance to resistance-capacitance coupling between amplifier stages.	3K2020143.
C6, C14	CAPACITOR, fixed: mica; 820 μμf ±2%; 500 vdcw; JAN CM30D821G.	C6—Same as C5 C14—Provides proper frequency response in F1A line and HA1 receiver weightings.	3K3082143.
C10, C11, C12.	CAPACITOR, fixed: paper; 10,000 μμf +20% −10%; 600 vdcw; JAN CP26A1EF103V.	C10 and C11—Provide a flat response to the amplifier (switch K3 in flat position). C12—Associated with C13 and C14.	3DA10–334.
C13	CAPACITOR, fixed: mica; 620 μμf ±2%; 500 vdcw; JAN CM30D621G.	Same as C14	3K3062143.
C15	CAPACITOR, fixed: paper; 20,000 μμf ±20%; 120 vdcw; JAN CN22E203M.	Provides the amplifier with a flat response over the entire range.	3DA20–246
C16	CAPACITOR, fixed: paper; 500,000 μμf ±10%; 200 vdcw; JAN CP54B1EC504K.	Audio-frequency bypass capacitor	3DA500–639
C17	CAPACITOR, fixed: ceramic; 10,000 μμf −0 +20%.	Same as C15	3DA10–539

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
VV1	CORD, switchboard: 2 cond, 6 tinsel strands; red and white braid; JAN Plug PJ–627 one end, 2 spade term. other end.	Cord is connected internally to measuring set. Plug is inserted in appropriate jacks.	3E7420.15
CR1, CR2	CRYSTAL UNIT, rectifying: peak back voltage 75 v, 800 μa at 50 v; forward voltage 2 v, 5 ma at 1 v.	Rectify the amplified alternating currents in the output circuit for d-c supply to the meter.	3J1N34A
J1, J2, J3, J4, J5, J6, J7, J8, J9, J10, J11, J12, J13, J14, J15, J16.	JACK, telephone: 2 cond 0.25″ dia plug; JAN JJ–087.	With cord VV1, provide the means of connecting circuit under test to appropriate weighting network.	2Z5598A–87
M1	METER, audio level: d-c; −7 to +10 db; movement, 300 μa full-scale deflection; black numerals, white background, with red mark for calibration.	For measurement readings in conjunction with db-dial settings.	3F3307.4–2
EQ1	NETWORK, equalizer: consists of capacitors, reactor, and resistors.	In combination with amplifier characteristics, provides required frequency weighting.	3F3502–1
P1	PLUG, telephone: 2 cond, twin shank; JAN PJ627.	Attached to cord VVI, for insertion into input jacks.	4C5103.27A
E1, E2, E3, E4, E5, E6, E7.	POST, binding: screw type, open; without wire hole, w/lock pin.	E1—For connecting ground lead E2, and E3—For connecting circuit under test. E4—For connecting Transmission Measuring Set TS–568/FT. E5 and E6—For connecting monitoring receiver. E7—Used with E6 for connecting external equipment.	3Z737–7.1
L1	REACTOR: filter choke; .1 hy, 40 ma; 150 ohms d-c resistance; HS metal case.	Serves the same purpose as C14	3C574D–2
	RECEIVER, telephone: 10,000 ohms impedance at 1000 cyc; 1000 ohms d-c resistance; one 2-cond cable; 2 spade-lug term; one stay cord hook.	Connected at the output of the measuring set binding posts E5 and E6. Used during measurement tests as an aid in identifying type of noise; for example, to distinguish between noise and cross-talk.	2B475–3
R1, R3, R4	RESISTOR, fixed: comp, 600 ohms ±1%, ½ w.	Provide proper input, impedance for the particular circuit under test.	3Z6060–101
R2	RESISTOR, fixed: comp, 150 ohms ±1%, ½ w.	Same as R1, R3, and R4	3Z6015–118
R5, R6, R7, R8.	RESISTOR, fixed: comp, 40,000 ohms ±1%, ½ w.	Same as R1, R3, and R4	3Z6640 96
R9, R10	RESISTOR, fixed: comp, 240,000 ohms ±5%, 1 w; JAN RC30BF244J.	Associated with R34, R35, and R36 in extending the measurable range of all network circuits except VOL.	3RC30BF224J
R11	RESISTOR, fixed: comp, 2000 ohms ±1%, ½ w.	Component of calibration circuit	3Z6200-206
R12	RESISTOR, fixed: comp, 50,000 ohms ±1%, ½ w.	Produces a grid leak and a 600-ohm impedance in the first stage of the amplifier.	3Z6650–212
R13, R16	RESISTOR, fixed: comp, 2 meg ±5%, ½ w; JAN RC20BF205J.	Screen grid resistor	3RC20BF205J
R14, R15, R17, R26.	RESISTOR, fixed: comp, 510,000 ohms ±5%, ½w; JAN RC20BF514J.	R14, and R17—Plate, or load, resistor in stages 2 and 3 of amplifier. R15—Grid leak resistor. R26—Provides proper meter setting for plate adjustment.	3RC20BF514J

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R18, R30	RESISTOR, fixed: comp, 300,000 ohms ±5%, ½ w; JAN RC20BF304J.	R18—Grid leak resistor R30—Same as R11.	3RC20BF304J
R19	RESISTOR, fixed: comp, 10,000 ohms ±5%, ½ w; JAN RC20BF103J.	Voltage dropping resistor	3RC20BF103J
R20	RESISTOR, fixed: comp, 68,000 ohms ±5%, ½ w; JAN RC20BF683J.	Same as R19	3RC20BF683J
R21	RESISTOR, fixed: comp, 100,000 ohms ±5%, ½ w; JAN RC20BF104J.	Same as R19	3RC20BF104J
R23, R37	RESISTOR, fixed: comp, 5000 ohms ±1%, ½ w.	R23—Component of equalizer EQ1 network. R37—Component of calibration circuit.	3Z6500–272
R25	RESISTOR, fixed: comp, 4900 ohms ±1%, ½ w.	Provides proper meter setting for filament adjustment.	3Z6490–7
R27	RESISTOR, fixed: comp, 5.1 ohms ±5%, ½ w.	Component of battery BT2 filament circuit.	3Z5995A1
R28	RESISTOR, fixed: comp, 60 ohms ±1%, ½ w.	Same as R1, R3, and R4	3Z6006–47
R29	RESISTOR, fixed: comp, 39,000 ohms ±5%, ½ w; JAN RC20BF393J.	To reduce monitor-receiver sensitivity to radio-frequency induction.	3RC20BF393J
R31, R33	RESISTOR, fixed: comp, 10 meg ±5%, ½ w; JAN RC20BF106J.	Components of calibration circuit	3RC20BF106J
R32	RESISTOR, fixed: comp, 120,000 ohms ±5%, ½ w; JAN RC20BF124J.	Same as R31 and R33	3RC20BF124J
R34, R35	RESISTOR, fixed: comp, 563.3 ohms ±1%, ½ w.	R34 and R35—Together with R36, they comprise the 30-db pad, which extends the measuring range for all input circuits except VOL.	3Z6056C3
R36	RESISTOR, fixed: comp, 38 ohms ±1%, ½ w.	Same as R34 and R35	3Z6038
R38	RESISTOR, fixed: comp, 110 ohms ±1%, ½ w.	In association with R39, C12, C14, and L1, provides a network for HA1 receiver weightings.	3Z6011–21
R39	RESISTOR, fixed: comp, 800 ohms ±1%, ½ w.	Same as R38	3Z6080–69
R40	RESISTOR, variable: WW, 10 ohms ±10%, 2 w; JAN RA20A1RD100AK.	Varies filament voltage by manual operation of FIL RHEO dial (fig. 1).	3RA1510
R41	RESISTOR, variable: comp, 250,000 ohms ±10%, 2 w; JAN RV4AUFK254C.	Adjusts amplifier gain by operation (with screw driver) of CAL ADJ (fig. 1).	3RV52532
R42	RESISTOR, variable: comp, 10,000 ohms ±10%, 2 w; JAN RV4USA103A.	Adjusts primary calibration by manual operation.	3RV41031
R43	RESISTOR, fixed: WW, 4.7 ohms ±10%, ½ w; JAN RU3B4R7K.	Component of V1 and V2 filament circuits.	3RU12807
E	SHIELD, tube: JAN TSFOT102	Protector for electron tubes V1, V2, and V3.	2Z8304.154
X1, X2, X3	SOCKET, tube: 7 cont miniature; 1 piece saddle mtg; JAN TSE7T101.	Receptacles for electron tubes V1, V2, and V3.	2Z8677.94
K1	SWITCH, lever: two position, locking; position 1 is 2C, position 2 is 2C; solder lug term.	Used to indicate effect of plate or filament voltage on meter needle while calibrating.	3Z9580–41.2
K3	SWITCH, lever: two position, locking; position 1 is 4A, position 2 is 4A; solder lug term.	Controls the three available sound weightings: flat, normal, and 70 db.	3Z9580–41.1
K2	SWITCH, push-pull: locking, contact form 2C; solder lug term.	Connects and disconnects electron tube battery supply.	3Z9815–15
K4	SWITCH, rotary: turn button type, 90° turn; locking; position 1 is 4A, position 2 is 4A; white arrow indicator on handle.	The 144 position is used for line weighting. F1A position is used for F1A and receiver weightings.	3Z9825–10.6

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
T1	TRANSFORMER, AF: input type; pri 600 ohms impedance, sec 50,000 ohms impedance; turns ratio of pri to sec 1 to 9; freq response 60 to 8000 cyc ±.5 db.	Grid transformer at input of amplifier	2Z9632.635
T2	TRANSFORMER, AF: plate coupling type; pri 30,000 ohms impedance, sec 2400 ohms impedance, ct; turns ratio of pri to ½ sec 5 to 1; freq response 60 to 8000 cyc ±.5 db.	Reduces noise currents to sensitivity of the meter; provides the monitor-receiver with an impedance comparable to the circuit under test.	2Z9631.419
T3	TRANSFORMER, AF: line type; pri 600 ohms impedance; sec 600 ohms impedance; turns ratio of pri to sec 1 to 1; freq response 60 to 8000 cyc ±.5 db.	Repeating coil used in all input circuits	2Z9637.135
T4	TRANSFORMER, AF: line type; pri 6000 ohms impedance; sec 600 ohms impedance; turns ratio of pri to sec 10 to 1; freq response 60 to 8000 cyc±.5 db.	Repeating coil used only in the BRDG input circuit in series with T3.	2Z9637.136
V1, V2, V3	TUBE, electron: JAN 1U4; amplifier	Provide three stages of voltage amplification.	2J1U4
CR3	VARISTOR: non-rectifying, bridge type; WECo D–98914.	Stabilizes oscillator output	4Z9750–5

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